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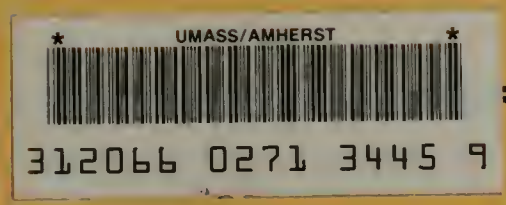

TEACHING CRITICAL AND CREATIVE THINKING: An Introduction to Programs and Practices

1986

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PUBLICATION #14160-98-2300-11-85-CR
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TEACHING CRITICAL AND CREATIVE THINKING:

AN INTRODUCTION

TO PROGRAMS AND PRACTICES

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PREFACE

This publication has been written primarily for educators of gifted and talented students at the elementary and middle school levels. Yet, critical and creative thinking, and teaching for thinking, can occur in all grades, and is applicable to all students, both in and out of the classroom. Hopefully, the ideas presented in this publication may be of interest to anyone--teachers, parents, and friends of young people--interested in promoting thinking in children.

Critical and creative thinking is a wide topic. It combines new strategies for developing and teaching higher level thinking with some familiar ideas that have been part of education for a long, long time. This booklet is merely an introduction. My hopes for you, the reader, are threefold: that you will discover some new and intriguing notions about teaching thinking, that you may find renewed value in some tried and true ideas, and that you might feel challenged to explore the topic beyond the limitations of this publication.

My approach has been partly analytical and evaluative, and partly speculative. Writing about critical and creative thinking is a curious task; if it is done well, the writer's own thinking should reflect and shed light on the subject matter. There were more than a few instances during the preparation of this booklet when I needed to remind myself to practice exactly those skills about which I was writing! In a similar spirit, the following material is intended partly to describe critical and creative thinking, and partly to invite it. By challenging my readers to think critically and creatively about their own thinking, hopefully I have created a situation where awareness of one's own thinking processes can serve as a model for the instruction of others.

Preparing this publication was a unique opportunity to meet and learn from many talented educators throughout Massachusetts. It was a special pleasure to discover and share in the deep interest so many people have in developing more effective ways to enhance giftedness in young students.

I wish to extend particular thanks to teachers in the systems of Acton, Framingham, Hanover, Orleans, Reading, and Triton Regional, as well as Gareth Matthews of UMass/Amherst, for sharing with me their programs and ideas.

My grateful thanks to Roselyn Frank, Director of the Office for Gifted and Talented, for the opportunity to do this work, and for her insightful editorial assistance. Thanks, also, to Joyce Wu, communications consultant, for her invaluable organizational and technical assistance, and to Sandra Ruiz, production assistant, who turned my manuscript into this publication.

Many people have been supportive and helpful. Special thanks to Jane Gaughan, who has been a wonderful partner in exploring much of this material, and to Rose Feinburg, who has given generously of her time and interest. Thanks to Robert Swartz, and the Critical and Creative Thinking Program at UMass/Boston, whose guidance and resources have made this publication much richer.

I am ever grateful to my family and friends for the time, patience, and thought they have devoted to assisting me in this project, and especially to my sister Andrea, whose conversation is a constant inspiration. Finally, a warm thanks to all my PACT students in the Needham Middle Schools who are proof that "teaching for thinking" is worth it!

Shari Tishman
July 1985

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I. INTRODUCTION

Recently, there has been a strong emphasis in education on "teaching for thinking"--developing higher level thinking skills throughout the curriculum. In this age of expanding information, young people increasingly need to be able to think for themselves. The aim is to teach students not only WHAT, but also HOW to learn. All students need to know how to ask and answer their own questions, and to make their own judgments and decisions. They need to develop skills that will help them effectively analyze and evaluate information, and allow them to combine and transform ideas and information into new ways of thinking and acting.

Programs for the gifted frequently focus on the teaching of higher level thinking. Gifted children in particular need the confidence, latitude and, above all, practice to create their own solutions to problems, puzzle their own way out of difficulties, and develop and implement their own ideas. Yet, "thinking" is a very broad subject. We use the word to describe just about everything that passes through our minds: from full-blown theories and visual images to daydreams and random ideas. In an educational context, thinking can be conceptualized as a series of ideas and mental techniques aimed at achieving a goal. The goal might be as mundane as learning the multiplication tables, or as complex as contemplating how to make the world a better place in which to live. However large or small the goal is, the thinking involved is productive; it accomplishes (a) specific task(s), and requires a variety of basic thinking skills.

CRITICAL AND CREATIVE THINKING

Critical and creative thinking can be considered higher level productive thinking. It does not involve memory, simple comprehension, nor recall; critical thinking is analytic and evaluative. Creative thinking synthesizes information; it develops new or unusual ideas. Though theorists may differ on which specific skills are considered critical and creative thinking, the following are generally accepted definitions.

> **Critical thinking:** The process of analyzing and evaluating statements, arguments, information, and experience.
>
> **Creative thinking:** The generation and combination of ideas and experiences to transform them into new ways of thinking, producing, and acting.

As these definitions illustrate, critical and creative thinking is nothing new. Teachers encourage a fair amount of critical and creative thinking in the classrooms every day. Every time a teacher asks students to evaluate some information, solve a problem, venture an opinion, or suggest an original idea, the teacher is asking the stu-

dents to use some combination of critical and creative thinking skills. But, students who are not practiced in the needed skills have difficulty completing the complex task that is asked of them. Teaching for thinking attempts first to isolate and define specific higher level thinking skills for educational purposes, and then "put them back together again" by applying the skills to various content areas.

If critical and creative thinking is nothing new, why has it become an issue, and how can it be taught? Are special courses needed? Special texts? Special training? Critical and creative thinking is unique in an educational setting--it is distinguished by its method, rather than its subject matter. It involves analysis, evaluation, transformation, and innovation, no matter what the content area. Teaching for thinking trains students to employ complex thinking processes in a variety of situations; it helps students to understand when certain skills and thinking processes are appropriate. In other words, teaching critical and creative thinking is teaching students how to think for themselves.

Ideally, we should continually develop critical and creative thinking skills throughout our lives. This publication is merely an introduction--an exploration of different programs in Massachusetts designed to teach thinking. It identifies some ways in which Massachusetts educators have incorporated critical and creative thinking programs into their curricula, and describes some of the attitudes, values and environmental factors that promote critical and creative thinking.

Below is a list of critical and creative thinking skills that is described and referred to throughout the book. It is not a list of all thinking skills; it includes only those aspects of thinking that can reasonably be taught to, and practiced with, gifted students at the elementary and middle school levels. Because noncognitive factors play a major role in stimulating thinking (e.g., more "bright ideas" are likely to occur in classrooms that support risktaking), a list of characteristics that foster critical and creative thinking (explored in Section VI) also is included.

Critical Thinking Skills and Processes

Reasoning

- Recognizing induction and deduction
- Identifying stated and unstated premises
- Recognizing fallacies
- Consistency in reasoning
- Identifying conclusions
- Recognizing similarities and differences
- Distinguishing between truth and validity

Language and Information

- Question clarification
- Identifying reliable sources
- Recognizing emotional language
- Categorizing information
- Defining the meaning of a word or statement
- Recognizing vague terminology
- Recognizing bias
- Observation and testing techniques

Judgment and Decision Making

- Collecting relevant information
- Deferring decision making while considering alternatives
- Implementing and monitoring decisions
- Recognizing and developing criteria
- Evaluating arguments and information

Creative Thinking Skills and Processes

- Fluency
- Flexibility
- Originality
- Elaboration
- Brainstorming
- Analogies/Forced relationships
- Attribute listing
- Modification techniques
- Fantasy/Imagery
- Mixing media

Characteristics that Encourage Critical and Creative Thinking

- Open-mindedness and risktaking
- Sensitivity to the feelings and abilities of others
- Self-confidence and self-reliance
- Tolerance for a "mental mess"
- Doubt
- Wonder and intuition
- Deferring judgment
- Humor

II. PROGRAMS IN MASSACHUSETTS

OVERVIEW

Although the teaching of higher level thinking skills often is included as one of the objectives of curricula for the gifted, there are relatively few programs in Massachusetts that are specifically devoted to teaching critical and creative thinking, and that have been implemented and monitored over the course of several years. Two "tried and true" programs are described in this section: Acton's Basic Challenge and Framingham's SAGE program.

Basic Challenge is designed to reach all students. It succeeds in challenging gifted students as well, and allows them to perform to their full potentials within a mainstreamed setting.

Framingham's SAGE program is a regular pull-out program for gifted and talented students that has been adopted by the National Diffusion Network (NDN) as a developer/demonstrator project.

Many educators of the gifted are currently experimenting with the teaching of critical and creative thinking, and several schools have just started or are thinking of starting programs that focus on critical and creative thinking. One example of a new program that is already showing signs of success is Hanover's SAGE program (unrelated to Framingham's), which is also described in this section.

BASIC CHALLENGE

Acton's Basic Challenge program was started in 1979 under an ESEA Title IV grant from the Massachusetts Department of Education. Although not specifically targeted for gifted children, the program encourages gifted students to achieve to the full extent of their abilities while remaining in a heterogeneous grouping.

The idea for Basic Challenge grew out of students' responses to Project Adventure, a physical education problem-solving program focussing on the development of risktaking and critical and creative thinking by presenting students with real-life physical problems to solve. Some elementary school teachers in Acton noticed that students who had participated in Project Adventure were beginning to take the initiative for learning upon themselves--responding to learning as a problem-solving challenge--and applying basic problem-solving techniques to everyday classroom situations. An enthusiastic core group of teachers got together and began asking questions:

> How can we teach a learning process that will more effectively develop basic thinking skills?
>
> How can we develop a similar sense of initiative and real-life challenge in an academic setting?

The program's goal became to teach, in grades 1-6, processes for developing thinking skills that, without altering the curriculum or general objectives of the school, could be productively applied to all types of learning situations and all subject areas.

During the first few years of its implementation, Basic Challenge defined three separate areas of skills: critical thinking; communication; and problem solving. For each area, the program defined a list of skills, and made recommendations for activities within the context of the regular curriculum that would promote the development of these skills.

Problem Solving
- analyzing
- finding ideas
- making decisions
- planning
- evaluating

Communication
- understanding audience and purpose
- finding topics and supporting them with details
- using specific vocabulary
- describing and persuading effectively

Critical Thinking
- questioning
- summarizing
- drawing conclusions
- making inferences
- distinguishing fact from opinion

After the first three years, Basic Challenge was tested and validated, in conjunction with the Title IV grant; the results were positive. Although the program no longer includes special testing, participants are scoring higher on regular tests, and teachers generally agree that the students are able to think clearly, concisely, and independently; moreover, they tend to practice the Basic Challenge strategies in many types of learning situations, both in and outside of school.

"Good problem solvers always feel they need to know more than they know," observes program director Caroline Tripp. The underlying philosophy of the problem-solving area of the program is students must <u>feel</u> challenged in order to truly acquire the necessary skill(s) to develop and implement an effective solution to a problem. "They must work with real limitations, unexpected impediments, deadlines that carry consequences," notes Caroline. "They must analyze, decide, plan, and follow through with whatever reading, writing, speaking, or math their proposed solution requires."

Students are asked to solve problems that arise from real situations in the school or classroom: from a broken terrarium to the staging/scheduling of a school play. School administrators and staff are

urged to regard students as problem-solving resources. One wonderful example is about a fifth grade class that was asked by the principal to help solve the problem of a messy and overflowing lost-and-found box. The first step the students took was to closely observe the problem; they noticed that the largest portion of the lost items belonged to first and second graders. Watching more closely, they discovered that younger children seem to have difficulty discerning their own belongings from a disorganized pile of hats, mittens, scarves, etc. The fifth graders then decided to try isolating the lost items, to test whether the items would be more easily identifiable. Several solutions were implemented, including a weekly display of selected items, and stringing lost items outside of first and second grade classrooms. Perhaps the most innovative solution was when fifth graders dressed up like scarecrows, with clothes pinned up and down their arms and legs, and strolled through the lower grade classrooms so that the younger students could hopefully identify and claim their belongings. The lost-and-found problem was finally solved!

One of the more striking features of Basic Challenge is its emphasis on valuing students' existing knowledge. Mariann Eden, a sixth grade teacher, uses a B.C. technique to begin a unit on Slavery in America and the Civil War. Mariann, a warm and responsive woman, believes that by appreciating what students already know, students are encouraged to become independent learners. "The children continuously keep an eye out for answers to their own inquiries," she notes, "and each individual's prior knowledge is made useful to the success of the unit." The unit on slavery is introduced with a critical-thinking activity that involves a triple question, which students are asked to brainstorm.

- What do I already know about the subject?
- What do I think I know?
- What do I need to know?

"The teacher's role," asserts Mariann, "is to act as a coordinator, facilitator, observer, and process analyst, while students chair the group session, record, report, and, in some cases, determine the direction of the next session."

Basic Challenge stresses that students be responsible for their own learning. In Mariann's class, students use the blackboard to list responses to questions. Brainstorming rules are in effect: anything goes; there's no judging until the session is over. Several times, highly questionable "facts" are listed under the "Things I Know" column, but are allowed to remain. Part of the critical thinking exercises later in the unit is to analyze the truth of these items, to support or refute them with reliable evidence. The "Need to Know" list is particularly long, illustrating Caroline's maxim about good problem solvers needing to know more than they know. At the end of the class, Mariann asserts that the more experience students have in Basic Challenge, the longer their "Need to Know" list tends to be.

The Basic Challenge classroom environment is open, flexible, and courteous; there is a high level of student participation, and respect among students for one another's ideas is evident. In the above activity, communication skills were being practiced as well. Students were anxious to contribute to the brainstormed lists, and, in several instances when a student was having difficulty expressing an idea, other students would helpfully clarify and organize the thought.

The program teaches open-ended thinking strategies that are limited only by the ability of the individual. Although skills are taught in a way to reach all students, the program is particularly well suited for gifted students. Emphasis is on self-reliance and self-motivation; gifted students frequently find themselves in charge when in small-group situations. Student interaction is stressed, as is valuing one another's skills and knowledge. Some Acton teachers feel that Basic Challenge is particularly good for gifted students because it requires them to apply their talents to realistic problems. It prepares them to thrive in real-life situations in which they will continue to find themselves throughout their lives. Mariann observes that "gifted students are learning to use the power they have to help other people not only realize that they, too, have powers, but also how to use them."

Basic Challenge stresses an awareness of thinking processes; in addition to acquiring basic thinking skills, gifted students practice "meta"-cognition--thinking about their own thinking processes, and reflecting upon which thinking skills are appropriate to specific problems or issues. "Thinking about thinking" binds together the learning of diverse thinking skills, as well as provides an opportunity for rich philosophical reflection. Perhaps above all, Basic Challenge serves the gifted by encouraging the open-ended, independent thinking that is so important to the development and unfolding of giftedness.

The aim is to revamp the teaching process, not the classroom content. There is a core group of about 27 educators who offer workshops in Basic Challenge techniques. The training reflects the program's philosophy that learning occurs most effectively when there is a real sense of challenge involved. Workshops encourage teachers to "give birth" to their <u>own</u> ideas about problem-solving and thinking skills. The workshops are offered to other school systems and, occasionally, teachers outside of Acton are invited to observe classes in which Basic Challenge is used.

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SAGE PROGRAM: FRAMINGHAM

Framingham's SAGE program was developed for gifted and talented students in grades 1-5. SAGE is not an acronym; the motto is "SAGE--the spice of learning for Gifted and Talented." In 1984, the program was adopted by the National Diffusion Network (NDN) and funded as a developer/demonstrator project. In other words, NDN recommended that SAGE be adopted by schools that were just starting a gifted and talented program or implemented by existing programs looking to strengthen or modify their curriculum. An introductory explanation of the program, and extensive teacher-training, curriculum, and indepth evaluation materials are available to interested school systems.

SAGE has two major aims:

- to develop higher order thinking skills; and
- to stimulate academic achievement.

These goals are achieved through a three-fold curriculum: thinking skill development, ministudy units, and independent studies.

SAGE emphasizes the teaching of critical and creative thinking throughout its curriculum. Diane Modest, the program's founder and director, explains that SAGE is based on a process approach towards learning. "Gifted students need the pyramid [of thinking skills] inverted. SAGE looks at critical and creative thinking as elements of the higher cognitive levels of thinking, according to Bloom's Taxonomy." The levels are analysis, synthesis, and evaluation. The whole SAGE curriculum involves thinking at these three levels.

SAGE activities help develop specific skills:

- observing
- classifying
- hypothesizing
- looking for assumptions
- summarizing
- coding
- problem solving
- comparing
- creating (imagining)
- critical thinking
- collecting and organizing data
- interpreting
- decision making

"Before starting a certain unit," Diane explains, "we concentrate on some basic thinking skills. The skills will then be intertwined with a content area."

In a unit on inventions, for example, students are each given a coat hanger and asked to "unhang" it and make something new, thus engaging in the process of invention themselves. They then discuss the kind of thinking involved when inventing something (these skills might include flexibility, orginality, evaluation, and decision making), and go on to use their "heads-on" experience in studying the inventions of others.

Another way critical and creative thinking skills are intertwined with the curriculum is illustrated by the ministudy, ROBOTICS. In one segment, "Why a Horsefly's Eye?" students read about an invention of a

new robotic "eye" that was inspired by the eye of a horsefly; the robot "eye" can see a full 210° (the human eye can see only 60°-80° at a time). Activities include:

1. Choose an outdoor scene; draw a picture showing how that scene might look to a horsefly. (The creative thinking involves internalizing the situation and making a creative connection between an everyday scene and the perspective of a horsefly. It requires students to be the horsefly.)
2. Make a list of at least ten other creatures that could be used as sources of ideas about how to improve robots. Make a chart or table to list the names of these creatures. Beside each name, describe that creature's special body part or ability that might somehow be incorporated into the design of a new robot. (This activity involves the full range of brainstorming skills--fluency, flexibility, originality, and elaboration--and integrates critical thinking skills to organize and categorize information.)
3. Choose one of the creatures you listed on your table/chart. Design a robot part based on the body part or unusual ability you described. (This activity involves creative elaboration, and the critical skills of judgment and decision making.)

SAGE students are encouraged to reflect on their own thinking processes. "We want students to assess why they are learning what they're learning," says Diane. Students are taught, for example, to identify fluency, flexibility, originality, and elaboration. They learn how creative connection making and flexible thinking, as well as analysis and evaluation, can be applied in any learning situation. This understanding of thinking skills, notes Diane, carries over into other areas, and SAGE students tend to have a better understanding of the learning process and the purpose of learning throughout all their classes.

Diane emphasizes the importance of a process-oriented approach when teaching for thinking. Critical and creative thinking should occur in all content areas, and students need plenty of practice employing these skills consistently and effectively. Exclaims Diane, "This is the most important aspect of a really successful gifted and talented program!"

For information about Framingham's SAGE program, contact:

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SAGE: HANOVER

Hanover's SAGE, unrelated to Framingham's, is an acronym for "Shared Approach to Gifted Education." Started in 1984, this program is relatively new, and is directed by Connie O'Brien, a veteran teacher and graduate of the Critical and Creative Thinking Program at UMass/Boston. SAGE, a combination mainstream and pull-out program, serves grades 3-5 students in three schools, and emphasizes incorporating critical and creative thinking throughout the entire elementary curriculum systemwide.

Pull-out

The pull-out component, based on Renzulli's Revolving Door model, offers participants minicourses in creative problem solving and in selected content areas involving Type III activities.[1] Although critical and creative thinking is incorporated into all the minicourses through training in philosophical discussion, creative problem solving, and argumentation, there also is an eight-week course specifically in that area.

Mainstream

Although SAGE is small, (Connie is teacher, director, liaison, and everything in between), the program is especially noteworthy for its successful shared approach to learning. Connie believes that, while critical and creative thinking is especially important for gifted students, it is equally important to share the learning of higher level thinking strategies with teachers and students in the regular classroom. When SAGE students return to their regular class after having attended a minicourse, they bring with them some new thinking skills. Connie goes into these classrooms and conducts demonstrations, highlighting critical and creative thinking, which provides additional practice for gifted students, and introduce other students to new thinking strategies. She also offers teacher training, and works with teachers to integrate critical and creative thinking activities into their regular lesson plans.

The program's weekly newsletter, which circulates throughout Hanover's elementary schools, reports on various SAGE activities, and includes a weekly critical and creative thinking exercise that focusses on a specific skill. All teachers are encouraged to contribute ideas and activities, and the newsletter is a forum for teachers to share their experiences in the teaching of higher level thinking. In addition, SAGE offers a series of inservice workshops and lectures for Hanover teachers on "Critical and Creative Thinking Strategies for the Regular Classroom," which is funded by the Department of Education's Commonwealth Inservice Institute.

---

[1] Renzulli, Joseph, **The Enrichment Triad Model**, Creative Learning Press. Mansfield, Connecticut.

The shared approach to learning encourages the inclusion of critical and creative thinking in all content areas, serving the needs of the gifted while, at the same time, benefitting the entire school system. "Everyone shares in this program," says Connie. "Everyone can participate, and this creates a feeling of ownership. It's not 'Connie O'Brien's program,' it's Hanover's."

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III. CREATIVE PROBLEM SOLVING AND CRITICAL AND CREATIVE THINKING

Creative problem solving is a complex thinking process that combines a range of critical and creative thinking skills to help conceive of, elaborate upon, and implement a solution to a specifically stated problem. It blends higher level thinking skills through analyzing, clarifying and organizing information to define the problem, and modifying and transforming the information into innovative solutions and inventions.

Although there are several different creative problem solving techniques, they are all basically streamlined variations of a certain approach to thinking. Eight possible stages in the creative problem-solving process and a list of some of the critical and creative thinking skills involved at each stage shown in Table III.A.

Three types of creative problem-solving programs are described below. These programs are all being used in Massachusetts; they are appropriate to elementary and middle school gifted students, and materials and/or teacher training for the programs are easily obtainable.

OLYMPICS OF THE MIND (OM)

OM's creative problem-solving process is divided into five stages.

1. PROBLEM STATEMENT

   Techniques: Redfinition
   Reversal
   Breaking problem down to its components

   Comments: Going beyond "functional fixedness" is stressed; i.e., seeing a problem not only in terms of how it has been solved in the past, and seeing an object not only in terms of its intended use.

2. IDEATION

   Techniques: Brainstorming
   Incubation (letting ideas and associations develop unconsciously)
   Journal--keeping of ideas, dreams, and daydreams
   Relaxation
   Concentration

TABLE III.A.

THE CREATIVE PROBLEM-SOLVING PROCESS

	Stages	Questions Asked	Skills and Abilities Involved
1.	Problem finding and defining.	What are the boundaries of the situation with which I am working?	Question clarification. Analysis of information.
2.	Information gathering.	What kind of information is appropriate and available?	Categorizing. Language and information skills. Creative research.
3.	Problem refining and formulation.	What is the specific problem I want to address? How can it be best expressed?	Judgment and decision making. Analyzing language.
4.	Idea search.	What are all the ideas for solutions to the problem?	Brainstorming: Fluency, flexibility, originality.
5.	Tentative solution--finding and combining.	Which ideas do I like best? How might they work together?	Categorizing information. Recognizing similarities. differences. Combining. Forced relationships. Modification techniques.
6.	Criteria development and application.	What criteria are applicable to choosing a solution to the problem, e.g., feasibility, humaneness, practicality, etc.?	Categorizing, judgment and decision making.
7.	Solution elaboration.	How can I make my best solution better? Are there aspects of other ideas that might enhance this solution?	Forced relationships. Modification techniques. Fantasy/Imagery.
8.	Solution implementation, monitoring, and "selling."	How can I apply my solution to the problem, test it to make sure it works, and convince people to use it?	Testing and observation. Brainstorming. Flexibility. Imagery.

3. JUDGMENT/EVALUATION

Technique: Reexamination of all ideas generated, and critical evaluation of each one.

Questions: Will it work?
How will it work?
If it won't work in its present form, how can it be modified?
Can any of the ideas be combined to work, or work better?

4. EXECUTION

Technique: Designing and testing the solution.

Questions: Can it be improved?
Can it be refined?

5. ELABORATION

This is the "styles component" of the process.

Questions: How can the solution be carried beyond its functional aspect?
How can aesthetics, presentation, theme, and saleability be taken into consideration?

The hallmark problem of OM is to design and build a structure out of balsa wood that will support as much weight as possible. This year, the specific problem, entitled "Compound Fracture," was:

> Build two support structures that will support a separate beam structure: a beam structure that supports the load-bearing structure, and a load-bearing structure that is in sole contact with the weights. These structures, when placed together, will balance weights and support as much weight as possible.[1]

Some limitations of the problem are: no strengthening of the wood by paint or lamination is allowed; the load-bearing structure must not exceed 6" in length; and no nails can be used, except for initial construction purposes. To an untrained eye in structural design, these structures look like densely built miniature railroad bridges, and hold what seems to be a huge amount of weight for their delicate appearance and size.

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[1] **Olympics of the Mind**, OM Association, Inc., Creative Problem Solving Process: 1978.

OM, started in 1978, is an international competition based on the varsity sports model. There are three divisions: grades K-5, 6-8, and 9-12. Students in the same school and division compete for positions on a school's team. Elimination trials are held by OM coaches who have usually, but not necessarily, attended OM coaching workshops. Any student may be invited to compete; however, teams usually are comprised of children in gifted programs. OM often is adopted as part of a gifted and talented program. The program maintains that the trials are beneficial even for students who do not make the team, because of the valuable practice in creative problem solving.

Once a team is formed, members learn and are coached in each step of the problem-solving process, then apply the process to a long-term problem, with which they will compete at the state tournament. The tournament also includes competition in spontaneous problem solving, and, in this way, both the process and the product of the team's efforts are evaluated.

Although educators in Massachusetts have been experimenting with the OM program for a while, 1985 marked the inaugural tournament in the state. The event was a gala and exuberant affair, sponsored by Lesley College in Cambridge. Twenty-two teams from seven school systems participated. A fine spirit of competition was in the air; students were intent and serious and, at the same time, enthusiastic, whimsical, and full of fun.

Learning, according to the OM philosophy, should be both challenging and enjoyable. During a demonstration of one solution to the "Compound Fracture" problem, a young clarinetist played fanfare-like music while his colorfully clad team mates gingerly placed weight after weight on their structure. When the structure finally collapsed (which they all eventually do), the teammembers invariably groaned loudly, then avidly examined the debris to figure out which part gave way, and why--a nice indication that the competition enhances learning, rather than the other way around.

OM's scoring system is quite detailed and comprehensive. While there is a definite winner in each event, every team wins something, and all effort is recognized and rewarded.

Triton Academic Regional School and OM

John Lovering is an eighth grade science teacher at Triton Academic Regional School in Byfield. He became interested in the OM program four years ago when he saw it on Bill Moyers' television special, "Creativity." Looking for new ways to foster problem-solving skills in students, he wrote to OM for information, and has been "hooked" ever since.

Although this is the first year Massachusetts has had an official OM tournament, John has been holding intramural competitions in his own school district for the past three years. Students seem to enjoy the team spirit and the challenge to their ingenuity and resources, which the unusual OM problems provide. The experience paid off: Triton performed brilliantly at the state competition in March 1985, and four of their teams were invited to attend the international OM competition, held in June at the University of Maryland. Winning teams from Barnstable and Sudbury also were to attend.

Although this is only the first official tournament year for Massachusetts, John predicts that the number of school systems involved will grow rapidly over the next few years. Why does the program catch on so well? "It's exciting," says John, "and as much fun for the teachers as it is for the kids. We [the teachers] really get to learn something."

John views the program as a combination of "yankee ingenuity" and concrete problem-solving skills. A fundamental rule of the program is that students must conceive of and test all their own ideas. The coach assists in the problem-solving process, but does not interfere in the actual generation and implementation of ideas, even if he "knows" that what the team is trying will not work. The philosophy is to promote self-reliance and independent thinking, and to insure that the learning that is going on is truly grounded in experience. "It's very, very frustrating for the teacher not to get involved in the solution," John says, "but it's good practice letting the kids think for themselves."

Judging by John's case, a coach's involvement can be extensive. He estimates that he has put in about ninety unpaid after-school hours this year, and, despite Triton's success at the Tournament, he's having difficulty raising funds to go to the "International." John strongly urges interested teachers to make sure of their system's financial support, and to seek corporate sponsors in the community as well. "The whole program is so exciting," he notes, "that teams and coaches become deeply involved very quickly."

This kind of enthusiasm fosters good learning. Asked what kind of thinking OM stresses, John replies without hesitation, "decision making and imagination. Figuring out new ideas, and how they can be put together. Self-motivation is a big factor, too," he goes on, "and learning how to transform pieces of information into useful ideas--the venting of curiosity. You wouldn't <u>believe</u> how curious these kids can be!"

Is special training needed to become an OM coach? Yes and no. Parents, as well as teachers, are encouraged to be coaches. For recruitment this year, John showed a videotape of the Bill Moyers "Creativity" program at a parent/teacher meeting. Trying to stir up interest in creativity, he engaged people at the meeting in some basic problem-

solving activities, explained the OM program, then invited anyone who was interested to attend an all-day workshop sponsored by the New Hampshire Chapter of OM. Prospective coaches are encouraged, but not required, to attend the workshop, which covers step-by-step the entire OM problem-solving process.

"We were kids for a day," John laughs. "It was great! We worked in teams, brainstormed, designed solutions...we even built structures out of balsa wood. We learned a lot about problem solving, and everyone enjoyed themselves."

The overriding message of OM is that competitive creative problem solving is challenging, educational, and fun. The hands-on aspect of OM problems give a real-life context to the practice of critical and creative thinking. The competitive challenge of team problem solving develops self-reliance in students, and insures that the thinking skills learned along the way will continue to be practiced far beyond the context of the OM competition.

Olympics of the Mind currently is sponsored in Massachusetts by Lesley College. For further information about the program, contact:

Olympics of the Mind
Lesley College
29 Everett Street
Cambridge, MA 02138

FUTURE PROBLEM SOLVING (FPS)

FPS, developed by psychologist E. Paul Torrance, is based on his belief that "the most basic skill that can be taught in today's schools is problem solving, especially skills in solving future problems."[2] The future, observes Torrance, is being made today. Now, more than ever before, we are able to study today's trends and forecast what will happen tomorrow. If we don't like what we see ahead, we can imagine alternatives, and use creative problem-solving techniques to elaborate upon, evaluate, and implement better ideas for the future.

FPS's goals are:

- developing critical and creative thinking skills,
- helping students to develop a futuristic perspective,
- encouraging students to make knowledgeable decisions after investigating varied resources,
- developing skills needed for teamwork and group process, and
- mastering skills of organization and precision in both written and oral communications.

The FPS process combines critical and creative thinking, while teaching students to define and focus on a problem, imagine several solutions, elaborate upon the best solution, and "sell" it to an intended audience. This process, Torrance maintains, gives students a practical, concrete skill with which they may affect the future.

There are basically six steps in the FPS process.

1. **Listing Subproblems.** In this brainstorming activity, the team tries to list as many additional problems as possible that might stem from the fuzzy situation.

2. **Identifying and Stating the Underlying Problem.** The brainstormed list is reviewed, and students look for the basic problem--the one problem that, if solved, would clear up many of the other problems. This problem is then stated for "creative attack." The wording is crucial, and guidelines are defined and agreed upon.

3. **Producing Alternative Solutions.** Like step one, this is a brainstorming activity. Teams list any and all solutions to the problem they can think of.

4. **Developing Criteria for Judging Solutions.** Three to five criteria are selected to evaluate the brainstormed solutions. Good criteria should have a single dimension, be a measure of degree, and indicate a direction. Some criteria might be: which solution will cost the least, be the most humane, or utilize the most natural resources?

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[2] "Resource Manual: Future Problem Solving Program," Coe College. Cedar Rapids, Iowa: 1983-84 edition.

5. **Evaluting Alternative Solutions.** Teams choose their ten best solutions and use a matrix to rank them according to the criteria. They then develop and describe the best solution in one or two paragraphs.

6. **Writing a Plan to Implement the Best Solution.** Teams identify who will be the most affected by the solution, and explain the necessary actions to implement the solution, using such questions as: Who will be affected? When will it happen? How long will it take?

Three to five students comprise a FPS team. The teams are given problems of significant social impact on the future. Past problems have included such issues as: drug abuse among the elderly, endangered species, the impact of robotics, drunk driving, genetic engineering, and the prevention of nuclear war. Each problem is explained in a "fuzzy situation"--a description of a possible future scenario that is still malleable and open to change. A bibliography of resources also comes with each problem. Teams gather information about the problem, discuss it, and try to recognize the facts and ambiguities in the situation, as well as identify the pertinent questions. Once teams have "talked the problem out," they are ready to begin step one of the problem-solving process.

Torrance has expanded this approach into a full-year national and international program for students in grades 4-12. The program now includes both curriculum for students and inservice training for coaches and other interestec adults. Each year, the program culminates in State and International "bowls," where teams engage in competitive problem solving, as well as scenario-writing competitions, visual arts and dramatic performances. and other creative approaches to thinking about the future.

Before entering the State Bowl, teams work on three practice problems during the year. The first two problems' solutions are mailed to and scored by trained evaluators. The solutions are returned with a score, along with comments and constructive criticism aimed at improving the team's problem-solving skills. The score of the third practice problem's solution determines eligibility for the State Bowl.

The evaluation criteria for the FPS process is quite detailed. Among the factors scored are: basic understanding of the problem, variety and flexibility of "subproblems" and solutions, quantity and quality of ideas, originality of solution, correctly used matrix, and relevance of the solution to the stated problem.

John Stewart and Orleans' Future Problem Solvers

John Stewart, of Orleans' school district, has been using the FPS program as part of his curriculum for gifted and talented elementary and middle school students. He has quite a track record: the previous two years he has brought teams in the junior division to the international competition in Iowa: this year, the intermediate division won the State "solution-selling" competition.

"The reason I first implemented the program," says John, "is because I seemed to have a talented bunch of kids who were all stuck in their own little worlds. Problem solving really gets the kids to work together--they come into the program feeling separate; they leave with a feeling of comraderie and a respect for one another's skills."

Although FPS is part of Orleans' program for the gifted, other students benefit as well. John tells the story about his eighth grade literature class, who was reading **On the Beach** by Nevil Shute, a novel about nuclear war. One day, the class was discussing some of the problems in the book, and some "ex-" FP solvers suggested that the class use the FPS process to explore the issue of nuclear war, using the novel as the "fuzzy situation." The class followed the whole process formally, including the "solution-selling" at the end. Students who had not been involved in the process previously were excited by it, and found it a realistic way to think the problem through in its entirety. Like many problems FP solvers tackle, nuclear war is a larger-than-life issue; though pertinent, students have difficulty thinking about it, and tend to deny or ignore its existence.

"The FPS process," notes John, "makes these kinds of issues 'bite-sized.' The technique makes kids feel as if they can come to grips with the problem--as if they can actually be part of the solution."

The FPS program was initiated in Massachusetts by two teachers of the gifted and talented, Mary Ann Haley and Marinel Johnson. The program is sponsored by the Massachusetts Association for the Advancement of Individual Potential (MA/AIP), Honeywell Information Systems, Inc., Lechmere, Inc., and the Massachusetts Department of Education's Office for Gifted and Talented.

MA/AIP has been particularly instrumental in developing the program into a full-year curriculum in Massachusetts, which includes three separate components: team problem solving, scenario writing, and visual arts. The scenario writing program invites individual team members to creatively describe an "alternative future" that might result from the implementation of the solution to a problem their team has developed. The scenarios can be in the form of a short story, journal entry, interview, etc. The visual arts program invites any student or group of students to create an artwork of any type that relates to one of the problem themes of the year.

MA/AIP added two new aspects to the program in 1985; the primary division and community problem solving. The primary division involves grades K-3. It is noncompetitive, and designed to help very young children to learn basic problem-solving skills. Community problem solving uses the FPS process to tackle real problems of today, such as safety in the workplace, or educating consumers about their electric bills. Problems and information are supplied by local businesses, who also help evaluate the solutions.

The materials of the program are quite comprehensive. The Handbook for Training Future Problem Solving Teams is extremely useful for classroom teachers. The handbook provides a clear and detailed description of creative problem solving, and suggests practice exercises for each stage, which isolate groups of thinking skills. Many of these exercises can be used independently of the formal FPS program. For example, there are brainstorming exercises that focus on creative thinking. The handbook explains brainstorming, suggests brainstorming topics, and provides general recommendations for stimulating creativity.

Any teacher interested in the FPS program must be willing to devote time to training and team practice. In some schools, the training takes place during class time; in others, it is held after school. Several hours of team training is necessary, and, in order to compete successfully, teams should consistently practice the critical and creative thinking skills the process involves. Torrance suggests that the program be used with gifted and talented students, and many school systems have adopted the program as part of their regular gifted and talented curriculum.

In 1984-85, there were 299 teams registered in the program throughout Massachusetts. Several resources--including seminars, written materials, training courses, and demonstrations--are available to anyone who is interested in the FPS program.

For more information, contact:

Ann Hoyle
Massachusetts Future Problem Solving Program
613 West Street
Wrentham, MA 02093

SYNECTICS

"Synectics" comes from the greek "syn," which means "together," as in synchronous or synthesis. The essence of synectics is creative connection-making--the joining of diverse elements in new combinations. For example, the question, "what is the texture of enthusiasm?" requires a synectic combination between seemingly unrelated domains--emotions and tactile sensations. Metaphors and analogies are the basis of synectics. As noted earlier, creative thinking has been defined as combining familiar ideas and transforming them into something new. The word "synectics" simply, but elegantly, expresses the spirit of this definition.

The notion of synectics was developed in the late 1950s when George M. Prince met up with W.J.J. Gordon, who had begun to research creativity. Together, the two men elaborated upon Gordon's work, and began to experiment with methods to teach creative thinking. In 1965, Prince and Gordon each formed their own company. Prince continued Synectics, Inc., and Gordon established SES (Synectics Educational Systems) Associates. Each man continued to contribute to the research and teaching of creativity.

Synectics, Inc.

The principal product of Synectics, Inc. is the teaching of a highly defined creative problem-solving process. Like most other creative problem-solving techniques, the process uses a combination of critical and creative thinking to produce innovative solutions to specifically stated problems. Although the major clientele is businesses, Synectics, Inc. does consult with and train educators to lead problem-solving teams of students. Synectics, Inc. has also occasionally worked directly with students, particularly gifted and talented students.

Students group together and work as a "consultant" to a client. The procedure involves the use of forced analogies to stimulate creative thinking. TABLE III.B.[3] lists the stages of the Synectics, Inc. process, with a sample problem that often is used as an illustration.

Synectics, Inc. offers consulting services, training sessions, and teaching materials. For information, contact:

Synectics, Inc.
Dunster Street
Cambridge, MA 02138

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[3] Prince, George M., **The Practice of Creativity**, Macmillan Publishing Company, Inc. New York, New York: 1970.

SES Associates

W.J.J. Gordon and Tony Poze of SES Associates are interested in the creative processes of learning and innovation--two processes that they believe are linked. Learning, they maintain, is a combination of focussing, connection making, and application. It is "making the strange familiar." Innovation is seeing something old or commonplace in a new light--breaking the connection to old ideas and replacing it with a new and richer connection. It is "making the familiar strange."

Learning occurs when students must internalize information. Effective internalization occurs when students connect the subject matter to something they already know. Analogies and metaphors are tools with which such connections are made, and the more profound the analogy, the more likely it is that the information will be successfully internalized.

Innovation, another word for creative problem solving, happens when an analogy is made from something familiar to something strange. Gordon advises teachers about the importance of understanding this concept. Creative problem solving will happen only when the student is sufficiently familiar with the subject matter to be able to "make it strange." If, for example, students want to work on a problem involving gravity, they must be familiar with the laws of gravity in order to make a creative connection to something seemingly unrelated. Without this familiarity, believes Gordon, any creative problem solving technique will only confuse the student.

The SES practice of synectics is the intended manipulation of analogies and metaphors in order to achieve insight. SES focusses on developing connection-making skills, and teaches students the powerful skill of deliberately producing their own analogies. The connection making involved in both making the familiar strange, and making the strange familiar, requires a blend of critical and creative thinking skills. Knowledge must be categorized, analyzed, and evaluated (critical thinking); and domains of knowledge must be combined and transformed (creative thinking).

The educational branch of SES is well developed, and has produced some exciting classroom materials, much of which is devoted to the development and practice of "strange and familiar" connection making. The **Strange and Familiar** workbook series, designed for elementary and middle school levels, provide challenging and imaginative connection-making exercises. As with creative problem solving, these exercises integrate critical and creative thinking in an effective learning strategy.

TABLE III.B.

SYNECTICS, INC. FLOW CHART

STAGES	COMMENTS
PROGRAM AS GIVEN Devise a closing top for a thermos bottle.	A one sentence headline of client's problem/opportunity
ANALYSIS There must be no strings or chains. It must not add more than 50¢ to the retail price. It must be easily cleaned. It must be safe for children.	Why is it a problem? What are the limitations?
GOALS AS UNDERSTOOD How can we make a thermos that closes when we want it to? How can we design a closing mechanism that doesn't take up any space?	How is the problem conceived by each member of the group?
CHOICE OF GOALS AS UNDERSTOOD	Leader chooses one goal that promises to be innovation producing and rich in analogy-making. At this stage, the goal need not seem realistic.
LEADER'S SAMPLE QUESTIONS There are three types of questions a leader can ask to elicit analogical responses: 1. A direct comparison of diverse categories, such as "what is an example of a closing mechanism in biology?" 2. Book Title: a compressed conflict or oxymoron that captures the paradox contained in a direct comparison.	Possible responses: • a clam • a flower in the evening • natural selection (the closing out of a species) • "protected vulnerability"

STAGES	COMMENTS
Leader's Sample Questions (continued) 3. Personal analogy: Leader asks students to identify themselves with the situation: • Imagine you are the clam. • How do you feel when you close up? • Think for a minute. Be the clam.	
CHOICE OF EXAMPLE The closing of an eyelid	Leader chooses one example to examine, based on three criteria: 1. Leader finds suggestion interesting. 2. Choice seems to have no direct practical relation to "the goal as understood." 3. Leader believes the group knows enough about the example to examine it.
EXAMINATION OF EXAMPLE Someone suggests that the eyelid example reminds her of the iris of an eye, and the way it closes.	Leader fosters imaginative ideas. Association is encouraged.
FORCE FIT Leader asks: How can we use the idea of an iris closing, combined with the "book title" protected vulnerability in reaching the "goal as understood?"	
VIEWPOINT Group selects one idea generated by the "force fit" and elaborates upon it. Leader asks: Develop an iris like a rubber top that contracts into a small space when open, and expands into a sealed valve when closed.	

Following are examples of exercises from these workbooks.

> Imagine that you are the last tiger in the world. All other tigers have been killed. Now they are rugs for the floor and decorations on the wall. You know this and you are especially careful as you walk along a familiar path. What do you think about and what do you look out for? BE IT! BE THE TIGER.[4]

The exercise below is a warm-up to a less obvious analogy.

> In this exercise, you will pretend to be the liquid inside a thermometer. A thermometer is made by putting a liquid into a skinny, closed-off glass tube. What makes it go down when it gets cold? What makes it go up when it gets hot? Let's make a couple of guesses to find out. First, we'll try to guess by remembering a feeling we've had. Pretend that you are in your warm bed on a frosty night. You don't know it, but the furnace goes off! You begin to feel cold, but you are too sleepy to get out of bed. So you curl up into a small ball to stay as warm and cozy as you can.
>
> Now imagine that you are the liquid inside the thermometer. It was nice and warm, but now it is getting cold. BE THE THING! How do you feel, and what do you do with your liquid body?[5]

As students gain practice making connections, the conditions get more elaborate, and the thinking skills involved become more complex. Later on, students are asked to explain and elaborate upon the connections they make.

> Who is BIGGER? A short, fat kid brother, or a tall, skinny father? Explain your choice.
>
> Which would you rather be? A crocodile living in Iceland, or a polar bear living in Africa? Explain your choice.[6]

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[4] Gordon, William J.J., and Poze, Tony, **Strange and Familiar, Book** III, Porpoise Books. Cambridge, Massachusetts: 1985. pp.1-2.

[5] Ibid, pp. 5-7.

[6] Ibid, p. 40.

The next workbook in the **Strange and Familiar** series continues to develop creative connection making through comparisons:

> Which weighs more, a boulder or a heavy heart? Explain your choice.
>
> Which grows more, a tree or self-confidence? Why does your choice grow more?
>
> Which is noisier, a worm digging or a plant growing? Why?"[7]

When students have had plenty of practice with connection making, problem solving is introduced. The following problem from the workbook illustrates the problem-solving process used. Notice that the "problem" has to do with something very familiar.

> SAFE SAFETY PIN-O-RAMA[8]
>
> Invention problem: Invent a safety pin that holds things together but will never stick anyone. This must be your own invention, something that never existed before.
>
> 1st phase of invention process: What plant or animal 'pins' things together so that they don't come apart?
>
> 2nd phase of invention process: How does your plant or animal do it and how does it let go? Must you do something to make it let go? Describe the special parts of your plant or animal that 'pins.'
>
> 3rd phase of invention process: An inventor's first notion usually is a bit crazy and unworkable. Later he makes it practical and useful. So don't worry about how foolish your first idea may seem. What invention would you have if you used the 'pin' part of your animal or plant just the way it was?
>
> If you changed it a bit to make it do its job better, what kind of invention would you have?
>
> 4th phase of invention process: Now is the time to see if you can be practical about your crazy ideas in the 3rd phase. What must be done to make a really safe safety pin that people might buy? Be as simple as possible.
>
> 5th phase of invention process: Make a sketch of the 'pinning' idea that is a result of your thinking.

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[7] Gordon, William J.J., and Poze, Tony, **Strange and Familiar, Book IV**, Porpoise Books. Cambridge, Massachusetts: 1972. pp. 9-10.

[8] Ibid, pp. 26-28.

The essence of this problem-solving procedure is to make an analogy between two diverse areas of knowledge--plants or animals, and safety pins--and then to explore the forced relationship in order to gain insight into new ways of thinking about and making safety pins. Critical thinking is used to analyze existing knowledge, and creative thinking is applied to making an analogy, imaginatively elaborating upon it, and visualizing an alternative.

SES Synectics is particularly useful with gifted students in a mainstream setting. The teaching of connection-making skills benefits learners of all levels, maintains Gordon, without hindering the development of any particular group of students. Slow and average learners have the time to focus on content, while in the same lesson, more accelerated and gifted learners have the opportunity to bring connection making to a conscious level, and to use it as a basis for creative extension. As the creative process becomes more explicit, students can manipulate and build upon it in various imaginative ways. "The fact that these skills can be applied to a wide range of learning abilities," asserts Gordon, "means that teachers can employ a single teaching strategy to attain their goals. Thus, gifted students gain creative fluency while other students increase their learning effectiveness."

SES Associates has much to offer educators. Their workshops include "Teaching Gifted/Talented Students to Think Creatively," "Developing New Curriculum," and "Creative Problem Solving." Classroom materials include workbooks for grades 2-12. Teacher materials include a source book, an activity book, and teacher training.

For more information, contact:
SES Associates
121 Brattle Street
Cambridge, MA 02138
(617) 868-5747

We have seen how creative problem-solving strategies can be applied to a variety of problem situations. While creative problem solving does integrate critical and creative thinking, it should be noted that the processes described in this section have stressed the development of creative thinking skills more fully than the development of critical thinking skills.

Additional practice in critical thinking can be worked into creative problem solving through the initial analysis and clarification of the problem situation, and by expanding upon the "criteria" component of the processes.

As Robert Swartz of the Critical and Creative Thinking Program at UMass/Boston points out, a number of schools and school systems have started to move in this direction. For example, groups of teachers from the Groton and Westford systems, and from the Veterans Elementary School in Provincetown, have worked together to complement problem-solving strategies and the corresponding emphasis on creative thinking with some of the latest conceptual approaches to critical thinking. These new approaches, according to Professor Swartz, focus on three areas: (1) assessment of the reliability of information sources, including eyewitness testimony and observation; (2) reasoning, including the use of evidence, especially in causal claims and traditional deductive logic; and (3) a systematic critical approach to practical reasoning and values. This approach goes well beyond the use of the broad category of evaluation found in Bloom's Taxonomy or in standard problem-solving approaches. It focusses in a systematic way on these three main subcategories of critical thinking, as well as on many of the subskills they comprise, such as determining reasons, uncovering assumptions, and determining the meaning of statements.

Such concepts of critical thinking stem from the writings of philosophers such as Robert Ennis, developer of the famous Cornell Critical Thinking Test, and from recent work done in California and Connecticut in articulating goals for infusion of critical thinking into the statewide curriculum.

The groups of teachers in the school systems mentioned above have infused critical thinking skills into their standard instruction by restructuring what they teach. History lessons, for example, have been recast so that students stand back from their textbooks and look to primary sources to determine the accuracy of textbook accounts. At the same time, they are introduced to the concept of the reliability of sources of information for classroom exploration. Science lessons are refocussed to emphasize critical observation and the use of observational claims in supporting judgments.

Other studies have been restructured to give students a chance to think about cause and effect, and ways of critically evaluating the strength of evidence needed to support causal claims. Causal connections and human responsibility are explored, for example, when studying the play "Romeo and Juliet" in an English course.

Some teachers have brought advertising into the classroom for critical scrutiny. They have used the work done in logic on informal fallacies of reasoning to help students learn to evaluate arguments presented in advertising.

Infusion of individual critical thinking skills into the curriculum in these schools and school systems goes hand in hand with attempts to use them in broader problem-solving contexts. Thus, some teachers have developed units on acid rain using broader problem-solving models and this new work in critical thinking. In one elementary school, the entire social studies curriculum is being revised through this enriched problem-solving model.

All of these activities are exciting, according to Professor Swartz. "Here, for the first time, we find groups of teachers working together to combine what others consider separate, or even conflicting, approaches to teaching for thinking into lessons and units that go well beyond anything available in any of the published materials. The combination of a systematic approach to creative thinking skills, supplemented by this new work on critical thinking skills, set in a problem-solving and decision-making framework, brings these teachers to the frontiers of work on teaching for thinking. The model for developing this material for the systems involved, as well as the results, are tremendously powerful and are already being looked at by other systems with similar interests."

Imagine that students are tackling the problem of environmental protection and find the following information.

> If we do not take immediate and extensive measures to protect our existing natural resources, we will have done irreparable damage to these resources by the year 2000.

Practicing critical thinking involves taking a close look at information. Where does the above statement come from? Whose viewpoint(s) does it reflect? Are there opposing viewpoints? Is the statement accurate? Is it based on reliable research and statistics? Students should learn to recognize arguments contained in information. In the above statement, the argument is <u>if</u> we do not project our natural resources, <u>then</u> we will do irreparable damage. What is unstated, though, is (a) the premise that irreparably damaging the environment is a bad thing, and (b) the conclusion that we <u>should</u> preserve our natural resources. Is this a good argument? Is the information on which it is based correct? Are the premises true? Is the form of the argument sound?

Knowing <u>why</u> it is good to protect our natural resources enhances clear, critical thinking about the criteria by which to evaluate proposed solutions to the problem. If there are differing viewpoints about the problem (e.g., big business vs. consumer advocates), one criterion might be that the solution take into account varying in-

terests. If the preservation of future generations is important, another criterion might be the durability and efficacy of the proposed solution over time. The clearer students are about the exact nature and scope of the initial problem, the better able they will be to find a relevant and effective solution.

(See Section V for ways to recognize and analyze arguments, and to evaluate information.)

IV. PRECOLLEGE PHILOSOPHY AND CRITICAL AND CREATIVE THINKING

WHAT IS PHILOSOPHY?

Ancient Greeks thought of philosophy as the broadest of all sciences; etymologically, philosophy is "the love of and search for wisdom," as illustrated in the Socratic technique of discovery through dialogue. Philosophy does not have to be thought of as a body of knowledge, but rather as an activity--a special way of thinking about ideas and information. Philosophical inquiry, the activity of philosophy, is a dynamic combination of curiosity and method that probes the foundations on which our opinions, experiences, observations, and ideas are based.

Critical and creative thinking is the backbone of philosophical inquiry. Critical thinking identifies problems and inconsistencies, and creates the need for philosophical speculation. Logic and reasoning are two methods for unraveling philosophical issues. Creative thinking--conceiving new possibilities, perceiving unusual relationships, and exploring new intellectual frontiers--combines personal insight and critical speculation to generate innovative ways of thinking about and solving philosophical problems.

Webster's Unabridged Dictionary defines philosophy as "...the universal science which aims at an explanation of all the phenomena of the universe...[it is] the collection of general laws or principles under which all the subordinate phenomena or facts relating to a subject are comprehended." Given this definition, educators are understandably wary of tackling philosophy in the classroom. It is the type of subject that wreaks havoc with the curriculum; it is undefinable, nontestable, complex, and vague. Yet, the rewards of discussing philosophy with young students, especially gifted ones, can be great. Philosophy gives students a chance to think about relevant issues that underlie several of their school subjects, and gives teachers the opportunity to think along with students about subjects of genuine interest and in considerable depth.

Despite the haziness of philosophy's definition, educators are beginning to teach the subject in elementary and middle schools, using new ways of thinking about the subject which involve a process approach. Two prominent thinkers in the field of precollege philosophy have emerged: Matthew Lipman, author of **Institute for the Advancement of Philosophy for Children**, and Gareth Matthews of the University of Massachusetts at Amherst. Before delving into their materials, it would be helpful to think first about what "a process approach" means.

Grant Wiggins, in his article entitled "The Place of Philosophy in the High School Curriculum," calls philosophy a "disciplined thoughtful-

ness." This idea can be expanded to provide a provisional definition: Philosophical inquiry is a disciplined thoughtfulness about foundational issues and ideas. A foundational issue or idea is one that lays at the root of thought or argument. For example, if you are comparing historical accounts of the civil war in social studies, the foundational issue might be the reliability of historical evidence, and, possibly even more deeply, the question, "How is it possible to be sure of anything that has happened in the past, and what do we use as criteria for certainty?"

Gareth Matthews, in his book **Philosophy and the Young Child**, provides the following example:

> Jordan [five years old], going to bed at eight one evening, asked, "If I go to bed at eight and get up at seven in the morning, how do I really know that the little hand of the clock has gone around only once? Do I have to stay up all night to watch it? If I look away even for a short time, maybe the small hand will go around twice."[1]

Jordan might be worried about not having enough evidence to really know what time it is, or he might be puzzling about applying generalizations from observed periods to unobserved ones. Despite his young age, it appears he is thinking about problems in the theory of knowledge (epistomology) that have been puzzling philosophers for ages. One might answer Jordan by reassuring him that the clock does not make mistakes, and stop the conversation there. In the right circumstances, however, Jordan's questions create a wonderful opportunity to practice critical and creative thinking about the problem of knowledge. Thinking critically, one might ask Jordan about what kinds of tests could be devised for checking the accuracy of the clock. How many times must the clock be right in order to make a reliable prediction about its accuracy in the future? Would a guarantee from the manufacturer be sufficient to ease Jordan's doubt? Thinking creatively, one might ask Jordan to suppose that this sort of time telling is unreliable. What would that change in our daily lives? In Jordan's life? Are there other ways to tell time? In a classroom setting, a discussion that involved these kinds of questions would be a "disciplined thoughtfulness about a foundational issue." The question, "How can we really know....?" can not always be answered, but while considering an answer, students can gain valuable knowledge about the way we think, and the criteria we use for making judgments.

Critical thinking in philosophy develops and analyzes reasoning. Critical thinking skills--analysis of information, induction, deduction, etc.--are the philosopher's tools for excavating and evaluating ideas.

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[1] Matthews, Gareth B., **Philosophy and the Young Child**, Harvard University Press. Cambridge, Massachusetts: 1980. p. 2.

Creative thinking locates or creates the idea to explore. It asks the crucial philosophical question, "What if....?" and imagines new possibilities, continually extending and challenging the scope of intellectual activity.

PHILOSOPHY AND GIFTED AND TALENTED STUDENTS

What makes philosophy especially suited for gifted and talented students? Each teacher who explores philosophy with students will probably develop reasons of his/her own. However, to this author, two reasons seem particularly important.

Firstly, many traits that are characteristics of gifted students are also characteristics of philosophers. Gifted students are known to have curious minds, the tendency to think independently, high tolerance for ambiguity, and persistence in pursuing a difficult problem. Good philosophers also have these qualities.

Curiosity

A curious mind does not accept the world at face value. For example, a curious mind puzzles about whether robots can think, if animals have a concept of "tomorrow," whether time has a beginning and an end, or if yesterday's events can really tell us anything about today.

Independent Thinking

Talking about unexplored subjects is not everyday fare. Discussion requires some risk taking and, often, some reevaluation of one's own positions and principles.

Ambiguity and Persistence

Philosophical questions are not always easy to answer, and, in fact, the questions themselves usually need to be clarified and restated. Question clarification is an important critical thinking skill that is essential in philosophy. One must be able to tolerate ambiguity, indefiniteness, and often confusion. But persistence in questioning, reasoning, and imagining may yield exciting results; thinkers who persevere gain a new awareness of how people think, a deeper understanding of language and perception, and a new appreciation of other people's ideas and opinions.

Secondly, teaching philosophy to gifted children results in a special kind of relationship. Philosophy permits teachers and students to explore together difficult and provocative ideas, and lets them become true partners in learning. The puzzles that philosophers pose are intrinsically interesting to open-minded thinkers of any age. As the following material illustrates, young students can bring relevant and profound insights to philosophical issues, based on clear and well-thought-out reasoning. The teacher's role is to stimulate and guide thinking. (S)he does not need to have all the answers, nor even all the questions.

PHILOSOPHY FOR CHILDREN CURRICULUM

"Strip away from traditional philosophy its formidable terminology," says Matthew Lipman, founder of the New Jersey-based Institute for the Advancement of Philosophy for Children (IAPC), "and what remains? A wealth of ideas [which can be rephrased in children's own words] and the discipline of logic."[2]

Lipman believes that you do not need the fancy labels in philosophy--metaphysics, aesthetics, epistomology, etc.--to think about traditional philosophical subjects. Philosophical inquiry is something at which children turn out to be particularly adept.

IAPC has published the most comprehensive precollege philosophy curriculum to date, the "Philosophy for Children Curriculum." The grades 3-12 curriculum includes student texts and instructional manuals. Each grade has a philosophical "novel" in which fictional characters of the same grade level engage in philosophical discussions and activities. The accompanying instructional manual provides additional questions, activities, and exercises that correspond to the issues raised in each chapter of the novel.

The general aim of the book, says Lipman, " [is to] promote the formation in the classroom of a community of inquiry such as is modelled already in the novel."[3] The specific aims of the program are fourfold.

- Development of reasoning ability
- Development of creativity
- Personal and interpersonal growth
- Development of ethical understanding

The curriculum emphasizes the compatability of logical reasoning and creative ability. Lipman believes that by emulating the discussions of characters in the novel, students will develop and sharpen their own reasoning abilities, and, with the aid of the activities in the instructional manuals, use their imagination to extend the scope of their reasoning to a variety of issues and problems relevant to their own lives. Also, claims Lipman, as students discuss, analyze and reflect together, they will develop a heightened awareness of one another's personalities, values, and interests. "This increased sensitivity," Lipman asserts, "is one of the more valuable by-products of classroom communication. Unless children have some insight into the

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[2] "Philosophy for Children Curriculum," Institute for the Advancement of Philosophy for Children, Montclair State College, Montclair, New Jersey. p. 1.

[3] Ibid., p. 65.

nature of the individuals with whom they share their lives, they are not likely to make sound judgments regarding them."[4] In the same spirit, students are encouraged to apply the critical and creative decision-making process to issues in their own lives.

HARRY STOTTLEMEIER'S DISCOVERY

The keynote novel in "Philosophy for Children Curriculum" is **Harry Stottlemeier's Discovery** (grades 5-6). The name "Harry Stottlemeier" is a word play on "Aristotle," the philosopher who invented syllogistic logic. This novel, and its accompanying instructional manual, was the first one to be written at IAPC, and has served as a model for the rest of the series.

Harry and his classmates are introduced to philosophy by Harry's inadvertent "discovery" of one of the basic rules of syllogistic reasoning. Harry is startled out of a daydream when his teacher asks him the question, "What has a long tail and revolves around the sun once every seventy-seven years?" Snapping to attention, Harry tries to think quickly. He remembers having heard earlier the statement "all planets revolve around the sun," so he answers "a planet." He is, of course, wrong. The correct answer is Halley's Comet. Later, reflecting on the class and his embarassment at being caught daydreaming, Harry discovers that a sentence that begins with the word "all" cannot necessarily be reversed and remain true. All planets may revolve around the sun, but it is not true that all things that revolve around the sun must be planets. Harry excitedly shares his discovery with his classmates, and the novel takes off from there.

The first theme taken up is the idea of "discovery." "What is unusual and surprising," the instructional manual notes, "is that the book begins with a discovery by a <u>child</u>, and it is not a discovery of a thing, but a discovery of an idea... this raises the question, did Harry 'discover' an idea or did he 'invent' it?"[5]

What <u>is</u> the difference between a discovery and an invention? Christine Redford, a fifth grade teacher at the Joshua Eaton School in Reading, has been using "Philosophy for Children Curriculum" for the last ten years. She suggests the following brainstorming activity as one way to further explore this theme.

> As a whole class, brainstorm several things that have been discoveries, and several things that have been inventions. Make a "not sure" column for items you do not yet know how

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[4] Ibid., p. 66.

[5] Ibid., Instructional Manual, **Harry Stottlemeier's Discovery**, p. 5.

to label. When you are finished brainstorming, categorize the items in both lists. Are there certain kinds of things that tend to be invented and other things that tend to be discovered? (Could Columbus have "invented" America?)

THINKING ABOUT THINKING

"Thinking about thinking" is an important aspect of philosophical inquiry, and is a main focus of "Philosophy for Children Curriculum." As the fictional characters think, reflect upon, analyze, and discuss the various issues raised in the novel, they engage not only in logical reasoning, but also in thinking about their own thinking processes.

Thinking about thinking can occur in many classroom settings. Often, we assume students know the difference between an individual thought and a specific thought process. For example, when we ask them to "be logical," "be imaginative," or "be creative," we are relying on their ability to identify and employ a specific set of thinking skills. But, how often do we give them a chance to really practice thinking about thinking? The following exercise, taken from the manual, is designed to help students think reflectively. The questions are sequenced first to remind children of their thoughts, and then to help them think <u>about</u> having thoughts. Because of this sequencing, the manual stresses asking these questions fully and in order.

Discussion Plan: Thinking about Thinking[6]

1. What happened to you a year ago that you can remember right this minute?
2. What was the earliest thing in your life that you can remember?
3. Is there one memory that is unforgettable?
4. Have you ever wondered why you remember?
5. Which do you prefer, imagining or remembering?
6. What have you wondered about in the past 24 hours?
7. Have you ever wondered why you wondered?
8. At this moment, right now, what are you thinking of?
9. Do you have favorite thoughts?
10. Are your thoughts in color, or in black and white?
11. Can you take a thought apart, the way you can take a watch or sentence apart?

[6] Ibid., p. 9.

12. When you're unhappy, are your thoughts also unhappy?
13. Do you ever think about your own thinking?
14. Right this minute, can you completely stop thinking?
15. Do you think when you're asleep, or only when you're awake?
16. Is it easier to think when you're taking a test or when you're taking a bath?
17. Do you sometimes think of more than one thing at a time?
18. Do you sometimes have strings of connected thoughts that move through your mind like connected railway cars?
19. Is there a difference between having thoughts and thinking?
20. Do you prefer to read about reading, write about writing, talk about talking, or think about thinking?

LOGICAL REASONING

Syllogistic logic is introduced by analyzing the language of Harry's discovery:

>>>> All planets revolve around the sun = TRUE

But, if you reverse the sentence....

>>>> All things that revolve around the sun are planets = FALSE.

"Real-life" students, by experimenting with subject-predicate reversibility, are encouraged to continue to explore the structure of logical statements. Teachers can easily generate examples of their own, such as:

- All toothaches are painful = TRUE
  All painful things are toothaches = TRUE or FALSE?
- All beagles are noisy = TRUE
  All noisy things are beagles = TRUE or FALSE?
- All unicorns are imaginary = TRUE
  All imaginary things are unicorns = TRUE or FALSE?

These activities naturally lead to more complex syllogistic reasoning. Does the same rule of nonreversibility apply to sentences beginning with the word "no?"

- No umbrellas are snowmen = TRUE
  No snowmen are umbrellas = TRUE or FALSE?
- No babies can fly = TRUE
  No flying things are babies = TRUE or FALSE?

RELEVANCE TO REAL LIFE

"Philosophy for Children Curriculum" tries to incorporate reasoning and philosophical content into real-life situations with which children will be familiar. The following excerpt from the text illustrates the flavor of the novels. Jill, a classmate of Harry's has thrown a slumber party for the girls in her class.

> "There's a tune just keeps going through my head," said Jill. "We have it at home on a record, and my brother keeps playing it. It's called 'Saucer's Appendage,' or something like that." Fran corrected Jill with a grin: "The Sorcerer's Apprentice." Jill laughed at her own mistake. "Anyhow," she went on, "it's like I'm haunted by that tune..."[7]

The girls go on to compare stories of thoughts that have stuck in their minds. They wonder if thoughts "haunt" you because of the memory of a strong impression, like a relative's death. But, Laura disagrees.

> [Laura] When I see the moon, it's because the moon is out there, making me see it, right? And in my mind just now I heard your voice because you were speaking to me. So I think that the thoughts that are in my mind are caused by things that are outside my mind.
> [Jill] That's ridiculous. There are all sorts of imaginary things that are only in my mind, and there's nothing like them outside at all.
> [Laura] Like what?
> [Jill] Like--well--vampires, and elves, and Frankenstein monsters.
> [Laura] Okay. It's true I don't believe in elves and monsters....but even with elves and monsters, there are real people who make them up and tell us about them, and make us think of them.
> [Fran] Laura, you keep talking about what's in your mind, and what's not in your mind. But what's a "mind?" And how do you know you have one?[8]

Teachers who have used this curriculum agree that students are able to relate to this type of dialogue. After discussing the difficulty of knowing what a mind is, one sixth grade gifted and talented class was asked to brainstorm some different uses of the word "mind." Here are some highlights from the list:

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[7] Ibid., pp. 27-28

[8] Ibid., pp. 27-28.

- I don't mind if I do
- I changed my mind
- mind boggling
- simple-minded
- narrow-minded
- mindless
- frame of mind
- peace of mind
- mind your mother
- mind your brother
- mind yourself
- mind your own business
- keep your mind on your work
- lose your mind
- blow your mind
- mind over matter

Several follow-up activities are suggested by this exercise.

- Different uses of the word can be categorized and analyzed.
- The definition(s) in natural language can be compared to and contrasted with a dictionary definition.
- Phrases can be interpreted literally as a starting point for creative visualization. (If he changed his mind, what did he change it into?)

Some stimulating questions about the mind are also included in the instructional manual.

- When you think, do you think in words or images (pictures), or both?
- When you are playing in the school yard, are there times when you have no words or images in your mind, and yet you feel you are thinking with your body?
- Would you rather think about your own thoughts, or other people's thoughts?
- Are there creatures that have brains but no minds?
- How do you know you have a mind?
- How do you know other people have minds?

Students tend to be intrigued with these types of questions. When Julie (eighth grade) is asked whether she thinks in words or images, she pauses for a minute, then declines to choose either category. She says that thinking is not really just a word, or just a picture. "Thoughts," she says, "are like a bubble floating across your brain that suddenly pops--poof--and then you know something." Her statement raises the issue of the mental representation of knowledge. Many professional philosophers and scientists share Julie's concern; few express it as clearly.

ONE TEACHER'S EXPERIENCE

Christine Redford, author of the "mind" activity, has been using "Philosophy for Children Curriculum," almost since its inception, with gifted students and in the regular classroom. Usually, she uses it

for three one-half hour periods a week during reading class. Even when she is not following the curriculum, however, she finds uses for variations on the exercises from the instructional manuals throughout her classes.

Christine was initially drawn to the program because it seemed to encourage the transference of critical thinking skills across varied disciplines. She found that students were able to think analytically in math, yet unable to apply the same critical skills, such as categorizing information and recognizing arguments, to reading.

"As a teacher," says Christine, "I carry philosophy over into all my subject areas." Reading these novels can encourage students to analyze language in the same way as they might analyze a math problem. They become more careful with their questions in all subjects--careful about what they are saying and careful about the logical consequences."

The exercises involving the reversibility of subject and predicate are a good example. "I've heard kids correct their classmates for saying 'he's always picking on me,'" Christine explains. "'What do you mean,' they'll ask, 'by always?'"

Christine believes that "Philosophy for Children Curriculum" allows each child to achieve to his/her own ability. Thus, it suits gifted students in either mainstream or pull-out classes. Christine has used the program successfully in both instances.

"When kids really think," she points out, "they have that eureka! feeling. As teachers, we are not always aware of it, and sometimes we water down that experience. With the Lipman material, gifted kids really get a chance to have this experience."

Lipman makes this same point when he introduces Harry by way of a "discovery." Children do think, do query and philosophize, and can get the same good feeling of excitement and accomplishment from thinking as adults do. This is more likely to occur when teachers provide an environment where thinking is encouraged for its own sake, rather than for the sake of the right or wrong response. Gifted students, with their characteristically high level of motivation, avidly participate in discussions that value, probe, and develop each individual's thoughts and opinions.

Naturally, the role of the teacher is central. A teacher must be able to ask questions and guide discussions about foundational issues without being too directive. That's not to say that a teacher cannot have opinions. (S)he can and should express an opinion when appropriate, but the classroom spirit should be one of open and exploratory inquiry, where each idea is evaluated according to its merits, not its author.

In answer to whether any special training is needed to use this material, Christine answers, "you really don't need a specific background. What you have to do is read the material, and think about it. The teacher's manual is the most valuable resource, because it can be used in many ways. It teaches teachers how to ask the right kinds of questions....what the important issues are. You must be flexible to make the best use of the material, but mainly you have to know how to have a good discussion."

And the risks? "Well," says Christine, "you must make a decision about what's the most important thing to you as a teacher. For me, it's to teach the kids how to analyze, and think for themselves." She pauses a moment, then laughs: "You know, kids will question you, too, and you have to be prepared to take it!"

For additional information on "Philosophy for Children Curriculum," contact:

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GARETH MATTHEWS: PHILOSOPHY AND THE YOUNG CHILD

Gareth Matthews, professor of philosophy at the University of Massachusetts at Amherst, is author of several books and articles on philosophy and children. His conversations with children have led him to believe that thinking philosophically comes naturally to them, and his observations have caused him to reject much of Piaget's theory of children's intellectual development.

The world, Matthews points out, can be a complex and puzzling place. As adults, we frequently abandon attempts to think philosophically about the world's complexities. Children, on the other hand, with their characteristic curiosity and openness, are often surprisingly receptive to some intriguing philosophical ideas.

Children tend to think hard about the meaning of words. One example of this receptivity is the idea of language and meaning. They question the fact that language can often be ambiguous; words often have two seemingly opposite senses or denote two different states of affairs. The word "crazy," for instance, is used to describe mental illness, as well as to express extreme appreciation ("I'm really crazy about that new hit video!"). In current adolescent slang, "bad" means "good." Bright children may wonder how words get their meaning in the first place, and how that meaning gets communicated. In deciding what word to use, you might point to that thing over there and say "chair," but how will others know that you are not really pointing to the color of the chair, or its legs or fabric. Philosophers call this the "ambiguity of ostension," or the difficulty of showing meaning through pointing. And there are other problems with language as well. How can one really <u>know</u> what a certain color is? You and I might call the same thing "green" because we have both been taught to associate all things of a similar hue with that label, but how do I know that what <u>I</u> see as green, you don't actually see as yellow?

These kinds of issues intrigue children as well as adults, and they are certainly ideas which concern professional philosophers, and have linguistic implications in many fields.

Matthews' books include examples of children puzzling about language, as well as examples of other philosophical queries. In his book **Dialogues with Children**, Matthews discusses a wonderful conversation among six-year-olds, taken from Vivian Paley's **Wally's Stories**. The following exchange occurs after Ms. Paley's class has planted lettuce seeds.

> [Eddie] How do we know it's really lettuce seeds?
>
> [Teacher] The label says "Bibb lettuce."
>
> [Eddie] What if it's really tomatoes?

[Teacher] Oh. Are you wondering about the picture of tomatoes with the lettuce on the packet? It's just an idea for salad, after the lettuce comes up.

[Warren] They might think they're lettuce seeds and they might not know.

[Earl] Maybe the seeds look the same as something else.

[Teacher] Do you think they could make such a mistake?

[Lisa] Just bring it back to the store if it's wrong.

[Deana] The store people didn't even make it.

[Eddie] You have to take it back to the gardener.

[Deana] Maybe they printed a word they wanted to spell the wrong way. Maybe they mixed it up.

[Eddie] They could have meant to put different seeds in there and then they turned around and went to the wrong table.

[Wally] The wrong part of the garden. The tomato part.

[Warren] So in case it's not lettuce it could be tomatoes!

Matthews points out that Eddie's question is about evidence and the warrant for knowledge. How can we be sure that what we are told, verbally or visually, is correct? Once Eddie raises the problem, the rest of the class is anxious to join in with additional reasons why the seed might not be a lettuce seed. The children are thinking critically about information they have been given (the picture of tomatoes on a lettuce seed package). They are analyzing information, exploring the notion of evidence, and developing criteria for reliability.

Inspired by this conversation, Matthews posed the problem of evidence and lettuce seeds to a group of musically gifted students in Edinborough, Scotland. (**Dialogue with Children** is an account of Matthews' year-long work with these students.) After the children discussed the problem for a while, the idea in logic of "sufficient conditions" was introduced. Technically, a sufficient condition occurs when anything that is the case of "A" is the case of "B." For example, jumping off the Empire State Building is a sufficient condition for dying, although it is not a necessary one; there are other ways to die. On the other hand, oxygen is a necessary condition of life, but not a sufficient one. Other things, such as food and shelter, are necessary as well.

A sufficient condition is the first term in a conditional statement (if "A," then "B"). If I jump off the Empire State Building, then I will die. After a brief explanation, Matthews asked his students what a sufficient condition for the statement "I know that the seeds in this packet are lettuce seeds" might be. Two suggestions were "plant all the seeds" and "see what grows." If lettuce grows, then I'll know

that the seeds are indeed lettuce seeds. Or, choose a sample and accelerate the growing conditions; make a prediction based on the results (an experimental approach). Lastly, simply trust in the authority of the label makers. If it says "lettuce seeds," then it must be lettuce seeds (an uncritical approach). By examining and evaluating the different suggestions for sufficient conditions, students applied critical thinking to a difficult real-life problem (the problem of evidence), and learned logic in the process.

As the above examples illustrate, philosophical ideas exist in many subject areas, and inquiry into these ideas is appropriate in any curriculum whose objectives include the development of higher level thinking skills. But, although we consider philosophy to be serious business, Matthews points out that much of philosophical inquiry starts as conceptual play and joke making. In fact, Wittgenstein maintains that "....a serious and good philosophical work could be written that would consist entirely of jokes."[10]

Children's conceptual play is an insight into reasoning when their comments poke fun at the untidiness of our logical or common sensical expectations. Their "play" can be an insight into language when the jokes suggest a deeper meaning to everyday usage.

Children's interest in philosophical issues is often signaled by their laughter at jokes or wordplays. Matthews recognizes this, and asks a group of his adult students, who were involved in reading stories to children, to note points in the stories where children laugh, and to return to those passages later for discussion. In **Philosophy for the Young Child**, Matthews cites this example from **Winnie the Pooh**:

> One passage that caused the children to laugh was the one in which Piglet's Grandfather is said to have two names, "in case he lost one." My students asked the children if they had two names and if the reason they had more than one was that they might lose one.
>
> "No, you can't lose your name," everyone said. Everyone, that is, except Adam. "What if you forgot it?" asked Adam, suggesting that one way to lose a name might be to forget it.
>
> "Well then," replied Jennifer, apparently somewhat annoyed at Adam's suggestion, "you could ask your brother." Adam wasn't satisfied. "But what if he forgot it?" Adam persisted mischievously. "Well then...," Jennifer's response trailed off into silence.[11]

Adam is enjoying the joke of being separate from one's name while

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[10] Malcom, Norman, **Ludwig Wittgenstein: A Memoir**, Oxford University Press. London, England: 1958. p. 29.

[11] Matthews, Gareth B., **Philosophy and the Young Child**, Harvard University Press. Cambridge, Massachusetts: 1980. pp. 62-63.

exploring the significance of names. How important are they? What would happen if you really did lose your name? Would you still be "you?" And what if you did not have a name in the first place, could you "find" one?

Lewis Carroll, another philosopher who appreciates conceptual playfulness also thinks about the meaning of names.

> "Don't stand chattering to yourself like that," Humpty Dumpty said. "Tell me your name and your business."
>
> "My name is Alice, but ..."
>
> "It's a stupid name enough," Humpty Dumpty interrupted impatiently. "What does it mean?"
>
> "Must a name mean something?" Alice asked doubtfully.
>
> "Of course it must," Humpty Dumpty said with a short laugh. "My name means the shape I am--and a good handsome shape it is too. With a name like yours, you might be any shape, almost."[12]

Humpty Dumpty is associating meaning with shape. This is a humorous point of view, but somehow logical when you consider onomatopoeia, when words sound like the thing they denote. Some issues children puzzle about include: How do words get their meaning? What might a language of sounds and shapes be like? Why do humans have language? What might have caused it to come about?

These are some of the philosophical issues children think about, and to which Matthews encourages adults to be sensitive. Although he does not write curriculum for precollege philosophy, Matthews does occasionally consult for programs for gifted and talented students. He teaches courses and workshops for adults, and has worked directly with gifted students in several systems, including Newton's Advance Challenge Program and Greenfield's program. For example, in the fall of 1985, Matthews will teach a course for gifted middle school students at Greenfield Community College (a free service for eligible Greenfield children). His course description is:

> In **Ozma of Oz** by Frank Baum, the mechanical man, Tiktok, is said to think, speak, act, and do everything but live. If you want to join this group and discuss interesting, but hard, questions like "Could a robot think?" write a brief answer to that question and send it in with your application for this workshop.

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[12] Carroll, Lewis, **Through the Looking Glass**, Puffin Books, Penguin Books. England: 1946. pp. 268-269.

Teachers interested in critical and creative thinking will find Matthews' work a rich resource. He shows how to engage students in higher level thinking while discussing subjects of genuine philosophical interest and substance. No prior background in philosophy is needed to enjoy Matthews' work, except a naturally curious mind, and a willingness to consider one's notion about what children think about in a new light.

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SUGGESTIONS FOR TEACHERS

If, after reading this section, you still are not sure exactly what the definition of philosophy is, that should not deter you from getting a philosophical discussion going in your classroom. Unlike other subjects, such as biology, which can be defined without being practiced, philosophy must be practiced in order to be known. Just as critical and creative thinking is recognized by its method rather than by its content ("thinking" can be about almost anything), philosophy is an inquiry into the foundations of many ideas or experiences. The best way to discover what philosophy is, is to plunge right into philosophical inquiry, even if you are unsure where the inquiry might lead. Gifted students make great partners in learning!

Here are some suggestions for getting a philosophical discussion going in your classroom.

1. Listen closely to what children say. Note which ideas they laugh about, and what sorts of things puzzle them. Several issues are raised in children's day-to-day lives that can be explored philosophically. On the playground, the complaint often heard is so-and-so "didn't play fair." What is "fair play?" Is it just following the rules? Are there times when fair play involves stretching the rules? (Perhaps the batter in a softball game has stumbled and hurt herself after swinging at a particularly fast pitch. Would giving her a second chance, even though it is not in the rules, be an example of fair play?)

   Sometimes we talk about children's rights, or the right to free speech. What is a "right?" Who decides what they are? Do all people have them? If children have a "right" to an education, whose duty is it to provide the education? If we have a "right" to free speech, does that mean we can say anything whenever we want?

   Children hear many different stories of "beginnings," from the beginning of the universe, to the beginning of the revolutionary war. Does everything have a beginning? Time? Space? Light? Is there a difference between asking how the world began, how ideas begin, and how Massachusetts began?

2. Use provocative pieces of literature to start discussions. Some stand-bys are **Alice in Wonderland** by Lewis Carroll and **The Wizard of Oz** series by Frank Baum, both of which present traditional philosophical issues in language that children understand and enjoy. Even if the complete curriculum is not used, excerpts can be taken from "Philosophy for Children Curriculum," or questions and activities can be taken from the PCC instruction manuals.

   Excerpts can be taken from "grown-up" books as well, and read to children to stimulate discussion. Everyone has their favorites--one bit this author has enjoyed is using the opening of Walker Percy's **Lost in the Cosmos--The Last Self-Help Book**. Percy asks

us to imagine that we are looking through a telescope, observing a planet with a red spot on it and several moons. After consulting a book on astronomy, we correctly identify the planet as Jupiter. He then asks us to imagine that we are "Ariess", reading our horoscope in the newspaper. We agree that we match the account of an "Aries personality," then suddenly realize we have read the Gemini column instead. We find the "Aries" column, and, though the description is entirely different, we again agree that it is an accurate description of our personalities. In fact, we recognize ourselves in all twelve of the astrological signs. "Why," Percy asks, "is it that you can recognize and identify the planets Jupiter and Venus after reading a little and taking one look, yet have so much trouble identifying yourself much better than you know Jupiter or Venus?"[13]

Knowledge presents some intriguing problems. What is the difference between knowing an object and knowing a person? What is the difference between knowing your best friend and knowing yourself? Students naturally have a vested interest in knowledge, and they can provide some interesting examples of their own that will enrich philosophical discussion.

3. Most importantly, ask yourself about what you have wondered--what puzzles or intrigues <u>you</u>! Interest is infectious. If you want to explore an issue, and you are willing to admit that you are not sure of the answer, enlisting a student's help in the inquiry may produce results that surprise and delight both of you.

For further reading about precollege philosophy, see "Thinking," a quarterly journal about philosophy and children, published by the Institute for the Advancement of Philosophy for Children, Montclair, New Jersey. Both Matthew Lipman and Gareth Matthews are regular contributors.

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[13] Percy, Walker, **Lost in the Cosmos--The Last Self-Help Book.** Washington Square Press, New York: 1983. p.11

V. CRITICAL AND CREATIVE THINKING: EXAMPLES AND ACTIVITIES

CRITICAL THINKING

An essential aspect of critical thinking is analyzing and evaluating claims to knowledge. A claim to knowledge simply is a statement or piece of information that asserts something. Some sample claims are: "It's raining outside." "My favorite color is blue." "Gifted students deserve special attention." Sentences that are not claims to knowledge include questions, "Where am I?" "How far must I go?" and imperatives, "Get lost." "Be kind to animals." Students should be able to recognize claims to knowledge, and distinguish between different kinds of claims.

To evaluate a claim, we need to know two things: the kind of claim being made, and what is needed to provide support for it. Consider these three statements.

1. In New England, everyone's mood improves in the spring.
2. All aunts that live in Boston are female.
3. All you need is love.

Each of these statements assert something, but they are different types of claims, and therefore require different types of support. Of course, many claims are made that are not supported. This does not mean a claim is necessarily false (or true); it just means that, if we want to critically evaluate a claim, we first must decide what type it is, and then what kind of support would be appropriate.

In the above example, the first sentence is a generalization made from an observation based, presumably, on the observer's experience. It does seem true that in this part of the country, everyone feels a little better when it is springtime, but what kind of evidence would we need to really be certain that the statement is a warranted generalization? (Note: the statement does not say "I feel better..."; it claims that everyone does.) First of all, we might recall our observations of past seasons and make our own generalization. We could conduct a survey of a cross-section of New Englanders, or there might already be relevant scientific information. For example, recently there has been extensive research on the pineal gland, the area of the brain that regulates animals' inner clocks, accounting for birds migration, bears hibernating, and, apparently, people's seasonal mood swings.

Whichever tack we choose, the evidence we gather from our investigation provides reasons to either accept or reject an initial claim. The type of evidence needed to prove or disprove a claim is empirical; it has to do with the investigator's own experiences, observations, and/or experiments. At least one of the investigator's senses is employed; empirical evidence always is read, heard, seen, touched, or

tasted. The statement "In New England, everyone's mood improves in the spring" is an empirical claim, and therefore can be supported by empirical information. A definition of an empirical claim is: a claim that purports to describe something in our world of experience, and which can be evaluated only by examining appropriate empirical evidence.

In addition to being appropriate, evidence also must be sufficient to warrant certainty about an empirical claim. A child makes the statement, "Women drivers have more accidents than men." When asked for a reason, the child claims that he's been in accidents when his mother or a friend's mother was driving, but never when his father was driving. This reason seems like a good one, but the evidence on which it is based may be too selective. The child may be in cars with women much more frequently than he is with men. Also, conditions may vary. Women may drive him around town in stop-and-go traffic (to school, soccer practice, etc.), while men may have driven him only on long trips. When evaluating empirical claims, it is important to seek out and consider as much relevant evidence as feasible.

When claims to knowledge are strung together, and some claims are cited as reasons for asserting others, this is called an argument. To accept one claim as true because you think it is well supported by another claim is called making an inference. Making inferences is the kind of reasoning appropriate to evaluating empirical claims. What we call an argument is simply a verbal or written record of reasoning.

Not all claims can be inferred from empirical evidence. The claim "All aunts that live in Boston are female" is a logical claim. It is true by definition. A necessary condition for being an "aunt" is "being female." If we consulted the city records and found that, indeed, all people listed as aunts were female, the evidence may be true, but it is irrelevant to the kind of claim being made. A logical claim must contain within itself the necessary conditions for assessing its truth-value. No empirical evidence is relevant.

Other examples of logical claims are "All hedge hogs are animals," "2+2=4," and "all animals need oxygen to live." No empirical observations are needed to know that these statements are true. The truth of logical claims is determined solely by employing the rules of mathematics or deductive reasoning, It cannot be true that there exists a nonfemale aunt, or a nonanimal hedge hog, just as it cannot be true that 2+2=7.

Deduction is the only appropriate support for logical claims. An argument that is necessarily true, and that does not rely on empirical evidence to connect its premises, is a deductive argument. Here is an example:

Premise: All hedge hogs are animals.
Premise: All animals need oxygen to live.

Conclusion: All hedge hogs need oxygen to live.

If "hedge hogs" are a, "animals" are b, and "things that need oxygen to live" are c, the form is: All a are b, all b are c, therefore, all a are c.

Often, claims to knowlege are empirical, but connected in such a way as to be necessarily true. These arguments are also deductive:

Premise a: If pigs had wings, then they could fly.
Premise b: My pig has wings.

Conclusion c: My pig can fly.

The presence of the conditional "If...then..." indicates a necessary condition. The rule is: If a, then b; given a, therefore b. The claim "my pig has wings," however, is an empirical claim. You determine whether or not it is true!

The rules of logic check whether we have performed logical operations correctly, i.e., if the argument form is valid. Empirical evidence determines whether or not an empirical premise in an argument is true. A good argument is a combination of valid form and true premises.

In addition to empirical or logical claims, there are of course real value claims. The statement "all you need is love" is one way of expressing one's belief that love is to be valued above all other things. This value can exist independently of observations based on experiences, or of conclusions deduced from necessary truths. But even though the truth of value claims may be subjectively determined, we can often gain a greater understanding of our values of analyzing the reasons why we make certain claims. Just knowing moral truths, even if they are that "right one," does not mean we are prepared to face life with ready-made good value judgments. We are all familiar with the value expressed by the statement, "honesty is the best policy." This statement seems like a good moral rule, but there are probably instances in all of our lives when we have chosen not to apply it. Perhaps a suicidal friend demands to know where the razor blades are. Even if we believe in honesty, we may choose not to tell him/her, in order to opt for a greater good--the preservation of a human life. Although we tend to state values in absolute terms, we often treat them as rules of thumb--something by which to go in most cases. If there are exceptions to certain rules, it is important to know which rules, and under what circumstances. This is the task of critical thinking.

Language is imprecise. Good decision making depends on a clear understanding of the case. Sometimes a value that appears to be expressed is really either an empirical preference stated as a value, or an empirical claim based on a much deeper value. The statement "blue is a good color" uses the word "good," but is really a statement of the preference of the observer, based on their experiences. The statement "children should know the meaning of work" seems to say that hard work is good for children. In reality though, the work is valued for the

something children get out of it--a feeling of satisfaction, perhaps, or a sense of accomplishment that inspires them to continue to apply themselves in the future. It is possible that two people might disagree about the statement "children should know the meaning of work," and, yet, agree that children should do things which give them a feeling of satisfaction.

Naturally, thoughtful people can truly disagree about certain values, and not all disputes about values can be resolved. Critical thinking helps to probe the language with which value judgments are expressed, to explore from whence they came, and to determine when and how they are useful in arguments and discussions.

In order to develop the critical skills needed to effectively evaluate claims to knowledge, students need practice in identifying types of claims, in determining what kind of support is appropriate for various claims, and in transforming ordinary language into logical propositions. The following activity is one way to introduce and develop these skills.

CRITICAL THINKING ACTIVITY

Determine the kind of claim each sentence is making (empirical, logical, or value judgment).

1. Cats are independent creatures.
2. Mr. Piggy went to market.
3. In order to be elected President of the United States, you must be at least thirty-five years old.
4. Mozart's music is truly beautiful.
5. Bach was a better composer than Mozart.
6. A rainbow will not bear the weight of a wheelbarrow.
7. To err is human, to forgive divine.
8. A mind is a terrible thing to waste.
9. No reasonable person gets out of bed before ten in the morning.
10. Most artists cannot explain their work.

Once you have determined the kind of claim being made, read the list again and decide what kind of evidence or reasons would support each claim. For instance, what might you do or see to be sure that cats are independent creatures?

CATEGORICAL STATEMENTS

To analyze sentences, it is sometimes helpful to translate ordinary language into simple logical propositions. One way to do this is to think of the universe as consisting of millions of different categories. The number of categories is limited only by your imagination! Categories do not have to be "real;" thinking in categories is just one way to organize thoughts in your mind.

There can be categories of things, such as "blue things," "big things," "stars," and "steamboats." There can be categories of combinations of things, like "blue stars," "big steamboats," and "stars that I wish upon." People can be put into categories too. There are "nice people," "cranky people," "people who live next door," and "people who ride in taxis."

Categories have relationships with one another. Imagine these two categories: "things that are animals," and "things that you like." You could say: "I like all animals," which is another way of saying that all things that are in the category of animals are also in the category of things that you like. Or you could say: "I don't like any animals," which means that no things that are in the category of animals are included in the category of things that you like. You might suddenly recall a pet rabbit you once had, and admit that some animals are not things you like.

Now, imagine that the letter "A" stands for the category of animals, and "B" stands for the category of things that you like. All the stituations that have been discussed can be put in one of the following four categorical forms.

1. All "A" are "B"
2. No "A" are "B"
3. Some "A" are "B"
4. Some "A" are not "B"

Here is another sentence that can be put into categories: "Smart people always take umbrellas with them when it's raining." There are two categories in this sentence: "smart people" and "people who take umbrellas with them when it's raining." How are the two categories related? If smart people always carry umbrellas when it rains, then one of the characteristics of being a smart person is taking an umbrella with you when it rains. So, translated into the logic of categorical forms, the sentence reads: "All smart people are people who take umbrellas with them when it rains." If "A" stands for the category "smart people," and "B" stands for the category "people who take umbrellas with them when it's raining," then the sentence can be reduced even further to "All 'A' are 'B.'"

With a bit of fiddling around, all the following sentences can be put into one of the four categorical forms noted above. See what you can do!

1. Crocodiles have tears the size of marbles.
2. Cream cheese sandwiches are very nutritious.
3. Nothing logical is ever puzzling.
4. Henry is at home.
5. All that glitters is not gold.
6. Unwholesome food should be avoided.

7. Most babies sleep a lot.
8. It's not only fools who are parted from their money.

Try making up four sentences of your own, one for each type of categorical statement.

Here are 12 criteria of critical thinking (R. Ennis, 1962) that are helpful guidelines to assess critical thinking abilities:

1. Grasping the meaning of a statement.
2. Judging whether there is ambiguity in a line of reasoning.
3. Judging whether certain statements contradict each other.
4. Judging whether a conclusion necessarily follows.
5. Judging whether a statement is specific enough.
6. Judging whether a statement is actually the application of a certain principle.
7. Judging whether an observation statement is reliable.
8. Judging whether an inductive conclusion is warranted.
9. Judging whether the problem has been identified.
10. Judging whether something is an assumption.
11. Judging whether a definition is adequate.
12. Judging whether a statement made by an alleged authority is acceptable.

Two additions to this list are:

- Recognizing bias in information.
- Identifying the intent of information, i.e., to sell, to persuade, to inform, etc.

CREATIVE THINKING

Critical thinking can be evaluated objectively--deductions are either valid or invalid; inferences are warranted or unwarranted; and premises are either true or false, or sufficient or insufficient to support conclusions. Creative thinking, on the other hand, is not as easily defined; an individual's personal experiences determine what is a new idea, or what is an unusual connection between ideas. To combine or transform familiar ideas into new ways of thinking or acting, students first must be able to generate ideas. The more ideas, or the more unusual the ideas, the greater the possiblility tnat creative connections will occur. Teaching creative thinking means giving students the opportunity to practice generating many new ideas, as well as practice making unusual connections between familiar ones.

The following section describes some techniques to generate and combine ideas, along with suggested practice activities to develop basic creative thinking skills.

Brainstorming

Brainstorming is a technique used to generate a large quantity and variety of ideas. Students are asked to freely suggest several alternative solutions to a problem--practical ideas, as well as "crazy" ones--and to withhold criticism and evaluation until a later time. Brainstorming can be practiced individually (sometimes called "spinning"), in small groups, or as a whole class. Brainstorming develops the following four creative thinking skills:

Fluency: The ability to generate a quantity of ideas.
Flexibility: The ability to shift categories of thought, to vary kinds of ideas.
Originality: The ability to conceive of truly unusual ideas or combinations of ideas, by society's standards.
Elaboration: The ability to modify and combine ideas to make them more detailed and effective.

Four ground rules should be observed during brainstorming sessions.

1. No criticizing or evaluating ideas while brainstorming. Ideas should flow freely, and students should refrain from commenting negatively or positvely on others' ideas.
2. Wild, crazy, and humorous ideas are acceptable. Sometimes ideas which seem bizarre or irrelevant at the time become practical when seen later from a different point of view. It is easier to tame wild ideas than to "beef-up" thin ones.
3. Quantity is desirable. The more ideas, the greater the chance of finding something good.
4. "Hitchhiking" is encouraged, i.e., students should express ideas suggested by someone else's thought.

During brainstorming sessions, ideas should be recorded for all to see. If done as a whole class, list everyone's ideas on the board; if done in small groups, ask students to share the task of recording.

Good ideas come in spurts. It often helps to impose a time limit on brainstorming in order to "force" ideas out. Sometimes, a plateau is reached after the first five or ten ideas, until students "shift gears." Take this into account and encourage students to persevere until the end of the designated time limit.

Here are some simple brainstorming exercises:

1. In 3 minutes, list all the possible uses for a Styrofoam cup. You can do whatever you want with it: fill it, crumple it, shred it, etc.
2. What is your favorite color? What are all the different things you can think of that are this color? List different kinds of things: thoughts, feelings, moods, etc.

3. The field of robotics is growing rapidly. Brainstorm all the potential uses of robots. Be imaginative!

4. Sometimes words have several different meanings. The word "lose" can mean many different things; e.g., you can lose your keys, lose your mind, or lose a game. Brainstorm as many different uses of the word "lose" as you can.

Forced Relationships

Another way to develop creative thinking is to practice "forced relationships," one type of analogy making. This technique involves comparing seemingly dissimilar things and making a creative connection. It encourages imagination, flexibility, and elaboration. Some questions that encourage creative comparison making are:

1. How is a smile like cool glass of water? Explain your answer.
2. How is an old sneaker like a city street?
3. What do a jellyfish and a crowd of people have in common?
4. How is your eye like the ocean?
5. Which is more dangerous--a tame lion or a wild spider? Why?
6. Which is more timeless--the universe or a person's lifetime? Why?
7. Which is sweeter--a rose or a sunny day? Explain your choice.
8. Which is bigger--a pyramid or a great idea? Why?

Have fun making up your own questions. Invite students to make up questions for each other.

Modification Techniques

Creative ideas do not always emerge in perfect, practical form. It is often necessary to elaborate upon or modify a good idea to make it really great. SCAMPER is a mnemonic for a list of mental operations that can help to improve ideas or solutions. Students can become acquainted with SCAMPER words (a colorful poster on the bulletin board is helpful), and be encouraged to apply the suggested operations to their work whenever appropriate.

S substitute
C combine
A add, adapt
M magnify, minify, multiply
P put to other uses
E eliminate
R reverse, rearrange

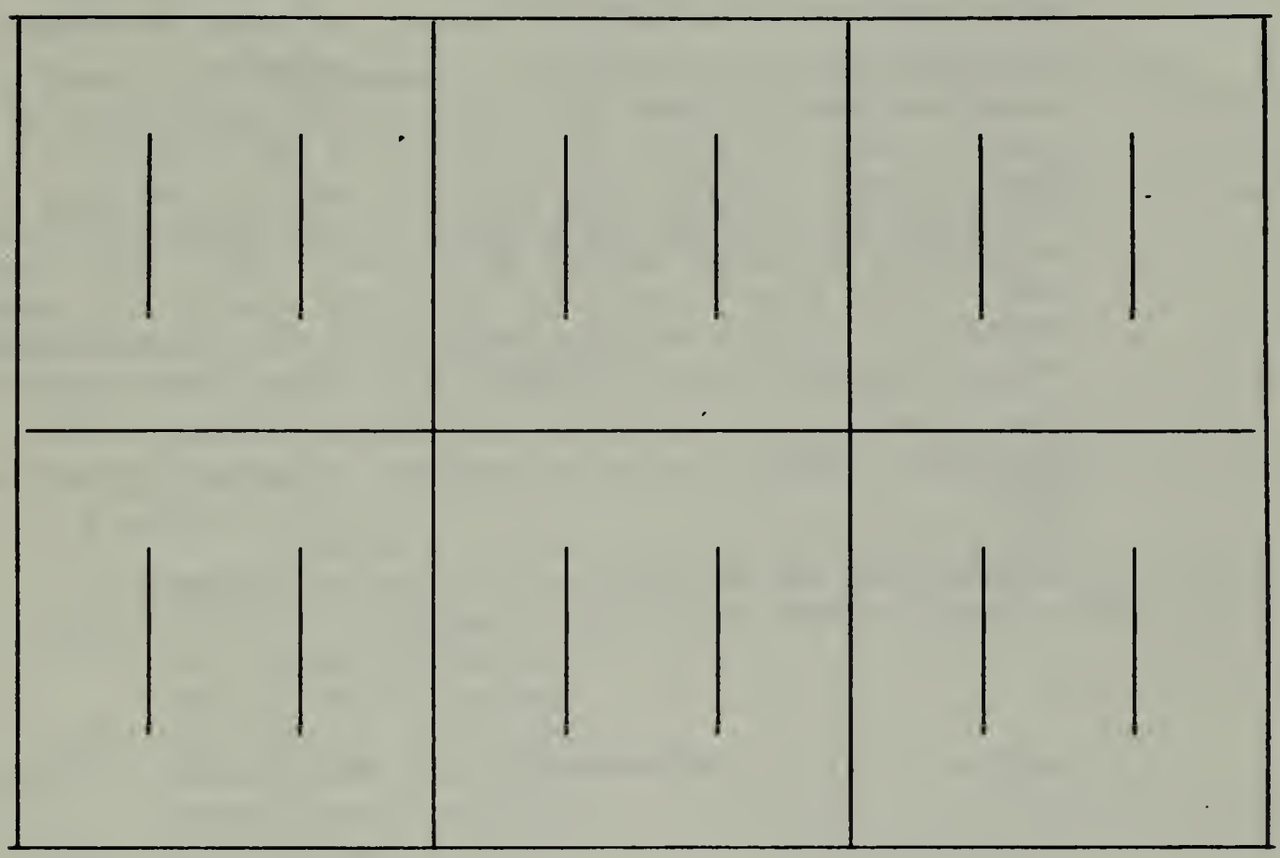
Most creative thinking activities in the classroom involve writing or speaking. However, creative thinking can also be expressed in several ways, and it is important to provide opportunities for students to explore alternative ways of developing and implementing creative ideas. The visual arts offer wonderful opportunities for creative expression, but, because thinking of good ideas often depends on being able to visualize new uses for familiar objects or materials, even students not artistically inclined need encouragement in "seeing" creatively. Curriculum for gifted students should include practice in analyzing,

manipulating, and reworking visual material. The two activities on the next page, adapted from the Torrance Test for Creativity, encourage basic visual thinking by developing fluency, flexibility, originality, and elaboration.

Creative thinking is expressed through movement, as well as verbally and visually. We realize this when we are involved in sports, dancing, and dramatics. Although creative movement activities offer excellent opportunities to develop basic creative thinking skills, they are seldom part of curriculum thinking. The creative movement exercise on pages 60-61 is described in detail so that a teacher with no prior experience in creative movement can feel comfortable leading the class.

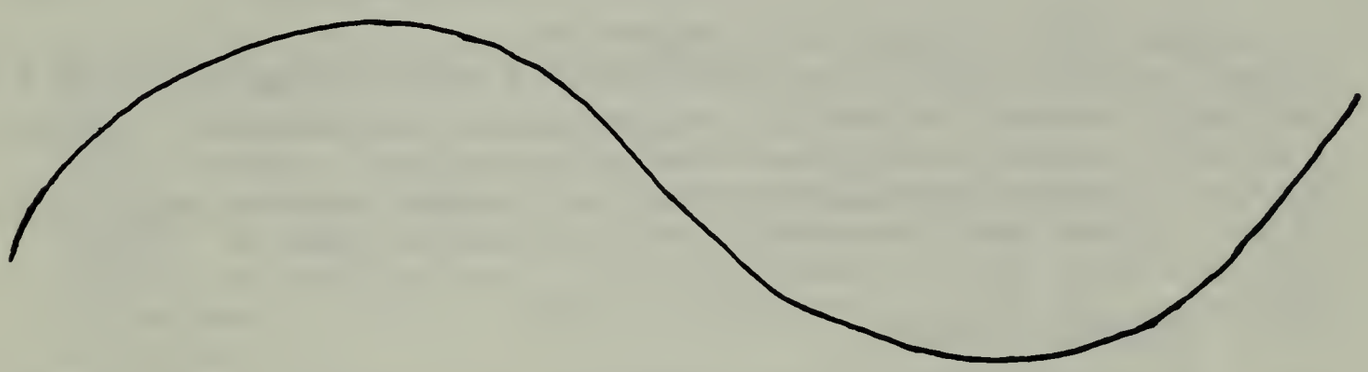
VISUAL THINKING ACTIVITY 1

Draw a picture in each of the 6 squares below, using the parallel lines in as many different ways as you can. Be imaginative!



(This activity can be done with 12 or more sets of lines to achieve greater results.)

VISUAL THINKING ACTIVITY 2: POINT OF VIEW



How many different things might this squiggle be? List as many ideas as you can. Try to vary your perspective as much as possible; e.g., it might be a river in the snow as seen from an airplane, the top of the letter "T," etc.

CREATIVE MOVEMENT EXERCISE (Led by teacher)

NOTE: Use a drum, handclap, or other sound to achieve "stillness," and to signal the end of each exercise.

Warm-up exercises

1. Centering activity to achieve focus. [sitting or standing]

   Everybody close your eyes and concentrate on relaxing. First, relax your head... then your neck... shoulders... all the way down to your toes.
   When you feel relaxed, gently start rocking your body forward and backward, like a pendulum swinging. Rock slower and slower until you find your exact center of balance. Now, rock from side to side. Rock slowly until you find your center of balance again. Concentrate on this point. Think about how it feels; remember it, and you can return to it whenever you want. Open your eyes.

2. Form a circle and walk clockwise around the room.
   [REMEMBER: make a sound to achieve stillness between each exercise!]
   Walk quickly, as if you're late for school.
   Go slowly, as if you have many things on your mind.
   Now imagine you're walking in deep mud.
   ... on slippery ice.
   ... against a strong wind.
   ... against a strong, COLD wind.
   Imagine you're walking through waist-deep jello.
   ... through peanut butter.
   ... on hot rocks.

Mime

1. Pretend you are pulling on a rope in a still photograph.
   Visualize an object at the end of the rope.
   Now pretend you are pulling in slow motion.
   ... in fast motion.

2. [Nonverbal exercise, demonstrating give and take.]
   Find a partner. Pretend you are each holding the end of a rope.

3. Pretend to open a refrigerator and look inside. Visualize what's in there, and pretend to eat something.
   Repeat the same routine, but pretend someone enters and catches you eating the frosting off a chocolate cake.

Creative thinking

[Clear a space and put a chair in the center of the classroom. Ask students to line up on one side of the classroom.]

1. In turn, everyone pass by or go over this chair in an unusual way [group brainstorming]. Each person must do something different.

2. Imagine that the chair is hostile. Show this as you pass by.
3. Imagine that the chair is very inviting, but you must pass it by.
4. Imagine that the chair is tempting you with something. You must choose whether to give in or resist.
5. Imagine that the chair has a secret to tell you. Show this as you pass by.
6. Imagine that the chair is an obstacle you must pass through. It can be anything you want. Try to show what it is by your response or reaction as you overcome the obstacle.
7. Repeat exercise #1: pass by the chair again in an unusual way. Do not repeat anything that has been done already.

Transition back to regular classroom

1. Walk in a circle around the classroom. Imagine that you are a cat exploring new territory.
2. Picture the most pleasant place you can think of, and pretend you are walking there.
3. Find a comfortable place to stand. Think about the center-of-balance activity and try to recall your center point. Remain there for a few seconds. Come alive.

COMBINING CRITICAL AND CREATIVE THINKING

Several basic thinking skills can be isolated for teaching purposes, but most higher level thinking depends on the integration of critical and creative skills. We have discussed how this works in creative problem solving and in philosophical inquiry. Below are some additional sample activities that integrate critical and creative thinking.

ACTIVITY 1. Advertising in Our Society

1. Advertising is infamous for faulty reasoning. For example, a celebrity might endorse a particular product, implying that because (s)he uses Brand X, you should too. Is the fact that Mr. Superstar uses a certain brand of toothpaste sufficient reason to believe that you should too? Some advertisements use pictures to persuade readers to buy their products. Cigarette ads often portray healthy, attractive people enjoying smoking. Does this mean that if you smoke a certain brand of cigarette, you too will be healthy and attractive?

   a. Choose a magazine and find five advertisements that give information (verbally or visually) that you do not think is supported. Explain your reasons, and describe what kind of evidence you would want before believing the claim the advertisement makes.

b. Choose any product (pineapples, stereos, vacations, etc.) and design an advertisement using one of the faulty reasonings you have identified. See how well you can disguise your faulty reasoning.

2. Every magazine is geared toward a particular audience. Sports magazines are devoted to sports fans, photography magazines to photography buffs, etc. Often, advertisers make generalizations about the types of people who read certain magazines in order to select in which magazines they will advertise. For example, car manufacturers might note that sports fans are more interested in buying motorcycles, while photographers may prefer Chevrolets.

   a. Choose a magazine and browse through it. Note what kinds of products are being advertised, and see if you can make a generalization about the types of persons most likely to read that magazine. Do they buy computer software? Go on vacations abroad? Eat frozen dinners? List your observations.

   b. Invent a character based on your research. Describe a day in the life of the type of person most likely to read this magazine. Describe where (s)he lives, what (s)he does for work, is likely to think about, etc.

ACTIVITY 2. Creative Categorizing

The ability to categorize information and recognize similarities and differences is an important part of critical thinking. Sometimes, though, it takes practice in flexible thinking to discover the similarities and differences among things. The handout sheet on the next page is a simple exercise to develop categorizing skills while using the creative thinking technique of attribute listing to develop fluent and flexible thinking.

ACTIVITY 2. Creative Categorizing HANDOUT SHEET

Place the words below in for different categories. The word lists do not have to be equal in length. Title each category.

thermos	french toast	briefcase
five dollar bill	snapshot	sugar
rug	unicorn	sidewalk
first date	feet	corral
sweet dreams		

Now, choose three words from the above list, and list five or more attributes of each word. An "attribute" is a quality that something possesses. There are several different kinds of attributes. Here are some attributes of "desk:"

usually rectangular	starts with the letter "d"
something NOT usually found in a kitchen	has four letters
something I need a bigger one of	an item in an office
something which tends to get messy	something to write on

List your words and their attributes here. Be creative! What unusual attributes can you think of?

Categorize the original list of words again, using new titles. How can your list of attributes help you to think up new categories? Try to find some imaginative title headings.

The activities that have been suggested in this section are descriptions of types of exercises that encourage critical and creative thinking. Educators, who possess the flexible imagination that the teaching of the gifted demands, will undoubtedly want to draw on their own resources to invent activities that can be integrated into existing curriculum, and are tailored to the specific needs of their students.

Most critical and creative thinking skills are included in the upper three cognitive levels of Bloom's Taxonomy of Educational Objectives--analysis, synthesis, and evaluation. The following list of questions and key words helps develop critical and creative thinking activities.

ANALYSIS

Analyze	Discriminate	Relate
Categorize	Distinguish	Explain
Describe	Recognize	What assumption
Classify	Support your	What do you
Compare	Indicate the	

SYNTHESIS

Write	Suggest	Plan
Think of a way to	How	Create
Formulate a solution	Develop	Synthesize
Propose a plan	Make up	Derive
Put together	What conclusion	Design

EVALUATION

What is	Select	Indicate
Choose	Which would you consider	Judge
Evaluate	Defend	Decide
Check	What is most appropriate	

VI. CHARACTERISTICS THAT ENCOURAGE CRITICAL AND CREATIVE THINKING

Successful critical and creative thinking means more than just acquiring information or specific thinking skills. It involves an appreciation of divergent thinking practices, in addition to traditional convergent thinking.

Most children's school experiences are geared toward producing answers--the "right" answers. Students are taught to value the right response above all else, and to measure knowledge by the quantity of known facts about a subject; critical evaluation can temporarily lead away from this certainty and fact-accumulation process. But, when work is assessed only by the "right" answer, the thinking processes that produce (or don't produce) the answer are virtually ignored. If we want to teach children how to think, we first must encourage them to adopt new attitudes towards learning by creating an atmosphere within which they feel free to explore, invent, and discover without the intimidation of feeling "wrong."

The materials and programs described in this book have stressed the value of the learning process--HOW you learn is equally important to WHAT you learn. This section discusses how values, attitudes, and the classroom environment can contribute to developing effective learners.

OPEN-MINDEDNESS AND RISK TAKING

"Right" answers or solutions to problems are not always obvious or readily available to a student. Often, a problem requires an original solution; additional questions need to be asked before an answer can be found. Openness to new ideas, and the taking of risks in exploring new possibilities, are important factors in critical and creative thinking. Successful solutions to problems involve creative problem solving (see Section III)--combining ideas, transforming ideas, creating new ideas. But students must first be able to confront the unexpected with confidence; they must be willing to risk uncertainty and failure when exploring new territory.

Classwork that requires an original response from each child encourages risk taking and open-mindedness. Activities should motivate students to describe their experiences, suggest their ideas, and express their opinions. This sharing of personal viewpoints helps students to both appreciate the individuality of their thoughts, and to respect and appreciate the ideas of others. Group exercises that value the diversity of student responses, such as brainstorming, also encourage risk taking.

Open-mindedness can be developed by making students aware of their own expectations. For example, students generally assume that written in-

formation, particularly textbooks and newspapers, is the "last word" in authority. But, sometimes, information is misleading, biased, or simply false. Social studies give students an opportunity to question the reliability of written information; by seeking varying accounts of historical and contemporary events, students learn to evaluate the objectivity of an observer or so-called authority.

Situations that confront students' expectations also can be a good lesson in open-mindedness. One teacher recalls a class studying the FBI. At the close of the unit, students invited an FBI agent to visit their classroom. Thrilled to be meeting a "real-live" undercover agent, students excitedly prepared extensive questions for him. They were quite surprised when "he" turned out to be "she," a plain-looking middle-aged woman wearing a conservative suit. Recovering from the initial surprise, the class proceeded with the questioning and soon discovered the many intriguing aspects of the woman's job. Discussing their expectations afterwards, the students agreed that, without really being aware of it, they all had assumed that the agent would be male, "kind of tough," and would probably be dressed in a trenchcoat with the collar flipped up. Talk about the influence of media on expectations!

SENSITIVITY TO THE FEELINGS AND ABILITIES OF OTHERS

People have different strengths in different areas, a fact especially evident in a setting where gifted students, with very distinct, yet diverse, talents, are pooled. Often, for example, verbally gifted students are active class participants, whereas students with "quieter" gifts appear to contribute less. Group activities that draw on diverse talents in the accomplishment of a single goal, such as problem solving, enhance individual students' gifts, and help students appreciate what others have to offer. One such program is Olympics of the Mind (described in Section IV). Some students may come up with wildly creative ideas for inventions, but mechanical, artistic, and/or technical skills are needed to implement those ideas. Using a broken lawnmower engine to power a robot may be a great idea, but first you need someone who can fix that engine. The ability to recognize and make opportune use of talent requires a sensitivity to the feelings and abilities of others. Activities that draw on diverse abilities help students develop important social skills, and also give them opportunities to be both teachers and learners among their peers.

SELF-CONFIDENCE AND SELF-RELIANCE

Before students learn HOW to learn, they first must have confidence in the value of their own thinking processes. An environment that encourages students to rely on their own resources to work through difficulties promotes appreciation for the input and ideas of all learners. A supportive classroom atmosphere, therefore, is integral to gaining self-confidence. Students must feel they have something to

offer: ideas should be shared out loud; written and visual work should be displayed. Children can share in creating the classroom environment by designing bulletin boards, discussing their outside interests in class, or suggesting topics of study.

Students develop self-reliance when encouraged to deal with a problem on their own, from start to finish. This can be accomplished in small but important ways. For example, instead of repeatedly telling students to keep the classroom neat, teachers can invite students to invent and implement a system that will keep the room organized.

Finding and using resources can also help develop self reliance. Students should be encouraged to find unusual resources when doing independent projects. The library is not the only information source; students should practice seeking information through interviews, films, writing letters, and contacting special interest groups and/or cultural centers.

TOLERANCE FOR A "MENTAL MESS"

Solutions to problems are not always immediately forthcoming. Sometimes it is necessary to sustain a high level of disorder before finding a great idea, as in brainstorming: ideas come fast and heavy; many suggestions contradict others; and holding myriad possibilities in one's mind simultaneously requires a healthy tolerance for disorderly and "messy" thinking. This "messy" thinking can be difficult for learners who are ingrained with the notion that there is only one right answer. Students need to be encouraged to refrain from judging ideas while in the midst of divergent thinking. They need to know that there are certain times when criticism and evaluation are appropriate, and other times when it's best just to let ideas flow freely. Two-part activities that clearly separate the no-holes-barred generation of ideas from categorization, analysis, and evaluation, help students understand that tolerating a mental mess is a vital step in the problem-solving process.

DOUBT

Even when an alleged authority makes a statement, the information is not guaranteed to be true. Sometimes, it is appropriate to be skeptical about given information, and to probe its reliability and source.

"Doubt" is an important element of critical thinking; it is unusual because it is effective not only when it is genuine, but also when it is contrived. We can intuitively feel doubtful, or we can purposefully employ questions and analysis to determine whether there is sufficient reason(s) to doubt something.

Doubt thrives in an environment that encourages questioning. Although it is a bad practice to believe everyone you read, the usual school

experience offers little or no opportunity to question information. To successfully teach thinking skills, students should be encouraged to question and analyze information presented authoritatively, and to make their own judgments about its reliability.

Activities that encourage doubt include analyses of media and advertising claims, such as the activity described previously in Section V. Even seemingly objective information warrants doubt. **The Journal of Irreproducible Results** is a wonderful collection of articles written by professional scientists who present highly questionable (and amusing) information in a serious scientific format. Article titles include "Recombinant Genetics and Animal Husbandry," "Anecdotal Evidence for the Existence of an Unfilled Niche," and "The Inheritance Pattern of Death."[1] Analyzing articles such as these illustrates for students how convincing dubious information can be.

The feeling of doubt is not always a result of conscious analysis. Sometimes we intuitively feel doubtful, without knowing exactly why. It is useful to examine statements and experiences which naturally give rise to doubt. The simple exercise below, suggested by Delores Gallo of the UMass/Boston's Critical and Creative Thinking Program, encourages students to reflect on the types of statements that can cause them to feel doubtful.

Exercise: TRUE OR FALSE?

TEACHER: [Each member of the class] Think of two true things about yourselves, and then one false thing. For instance, you might say "I love to play the piano!" or "My birthday is in January." or "My favorite color is green."

Everyone takes turn saying their three statements.....

TEACHER: [Rest of the class] Guess which two are true, and which one is false. Give your reasons for doubt. Note what feelings, observations, past experiences, etc. caused you to doubt a statement.

Although we want to encourage doubt in students so that they will examine the reliability of information, we must be sure to distinguish between a healthy attitude of doubting and a chronic skepticism that questions everything as a matter of course. Students should not be encouraged to doubt for the sake of doubting, but to supplant doubt with certainty gained from thoughtful and reflective critical thinking.

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[1] Scherr, Dr. George H., editor, **The Journal of Irreproducible Results, The Best of**, Workman Publishing Company, Inc.: 1983.

Doubt mainly has been described as a characteristic of critical thinking. While doubt is a critical tool, it leads to creative thinking when it illuminates the ambiguity or insufficiency of existing information, and creates a need in learners to generate new ideas, resources, and solutions.

WONDER AND INTUITION

Wonder is a confrontation with reality, which evokes questioning and contemplation in lieu of immediate judgment. As noted by Aristotle's remark, "philosophy begins in wonder," critical and creative thinking and philosophy are linked in that both can be conceived as the exploration of the foundations of all knowledge. Wonder is an expression of personal interest in an idea or phenomenon; it is a strong motivation for productive thinking because it indicates a genuine concern for the issue at hand. Dutch philosopher Cornelius Verhoven comments on Aristotle's remark:

> An introduction to philosophy is an introduction to the wonder that makes philosophy move. Without this movement, philosophy is merely an institution with which we become acquainted from the outside as curious tourists or, taking the inside view, as mere office clerks.[2]

Wondering tells us that there is something out there worth knowing. Earlier, we saw that creative thinking is "personal"--that part of the condition for the occurrence of creative problem solving is that the thinker makes the problem his/her own. Wonder indicates the beginning of this personal link, and the "movement" Verhoven describes is our own desire to probe, contemplate, and make sense of experience.

Wonder is not a cognitive skill; it cannot be voluntarily applied from within. In this sense, the educator's role is to inspire, not to inform. When appropriate, teachers should encourage and prolong classroom experiences that evoke a sense of wonder. Research has shown that when "wait time" is increased by even a few seconds, student response is significantly more thoughtful and original. The importance of "wait time" applies to wonder as well. If students feel overanxious about analyzing or judging a situation immediately, they may supress their natural inclination to wonder about a subject. The depth of understanding that wonder can bring can easily be overlooked in the haste to obtain the right answer. If, for example, a provocative poem or piece of prose is read in class, students should be allowed some time to appreciate it without immediately being required to analyze what it means. Or, if philosophical ideas are being dis-

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[2] Verhoven, Cornelius, **The Philosophy of Wonder**, The Macmillan Company: 1972. p. 11.

cussed, time should be allotted for open-ended questions before judgment on an issue is sought. If exciting visual material is presented, students should have time to "lose" themselves in the work, before dissecting or deciphering it. In science and the arts especially, confrontation with the unexpected can be so profound that to cut it short robs the experience of its pedagogical impact.

Wonder is not only a beginning that must be surmounted; but also a measure of the possibility of knowledge, and does not have to disappear as knowledge increases. This is evident as we gain expertise in a given area, and learn that the more we know about a subject, the more there is to be known. Although the feeling itself cannot be artificially induced, it is worth thinking about what experiences cause a feeling of wonder. Ask students what kinds of things they wonder about. What things do they think are "wonder"-ful? Why are the wonders of the world called wonders? Is there a difference, say, between wondering what time it is, and wondering about the existence of life on other planets? Questions like these help students to see that wondering is part of the learning process.

Wonder and intuition are closely linked in two important ways. On the one hand, both are indicative of an open-mind. On the other hand, both can be suppressed by the anxiety of needing the right answer. Wonder involves being open to the unexpected, and an open-mind is important preparation for the insight gained through intuition. Both wonder and intuition are experiential rather than conceptual; they are a feeling for, or identification with, the whole of something, rather than inference. Because of this, they can be extremely effective ways to achieve understanding. In **The Intuitive Edge**, Philip Goldberg writes:

> We think about intuition as a flash that comes and goes instantaneously. In that instant might be contained an extraordinary amount of information. If a picture is worth a thousand words, then an intuition might be worth a thousand pictures.[3]

Intuition, like wonder, is not a cognitive skill. Students should be invited to reflect on their own intuitions. What kinds of things do they "know" intuitively? What does an "intuitive flash" feel like? How is what is known through intuition different from what is known by doing arithmetic, for example?

An appreciation for wonder and intuition widen the scope of critical and creative thinking in the classroom, and helps students to feel that their own inner resources are of value in the learning process.

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[3] Goldberg, Philip, **The Intuitive Edge**, Jeremy P. Tarcher, Inc. Los Angeles, California: 1983. p. 72.

DEFERRING JUDGMENT

The ability to defer judgment when appropriate is crucial to successful critical and creative thinking. Critical thinking temporarily suspends judgment in order to objectively scrutinize and analyze information before coming to a decision about its reliability or completeness. Thinking creatively involves deferring judgment in two ways: by being noncritical while generating a large quantity of ideas, and by remaining open to wild and unusual ideas in search for original solutions.

Open-mindedness and wonder indicate a student's ability to defer judgment. Open-mindedness defers judgment while confronting the unexpected; wonder defers judgment in favor of exploring more deeply the "presentness" of experience.

HUMOR

Humor is essentially intellectual. It has to do with the inevitable comic clash between conception and perception, between intended and literal meanings, between expectations and reality. Humor is significant in higher level thinking because it involves a shift in perspective that can be the basis for analysis or original insight.

Language, with its many ambiguities and half-told truths, is fertile ground for humor. "Speech," says Voltaire, "was given to man to conceal his thoughts." This is perhaps a harsh view, but it does humorously point out that there is a great deal to be learned by paying attention to the difference between what is said and what is meant.

Wordplays make us reconsider the definition of a word, and also can suggest a deeper meaning to everyday usage. For example, there is the story about the two sardines who were startled in the depths of the ocean when a submarine glided by:

> "Goodness, what's that?" said one.
> "Nothing," replied the other, "just a can of people."

An interesting thought....to think of ourselves as "canned!"

Humor also teases us about the importance of defining our terms in discussions and arguments. R.L. Stevenson points this out in his little fable called "The Tadpole and the Frog:"

> "Be ashamed of yourself," said the frog. "When I was a tadpole I had a tail."
> "Just what I thought!" said the tadpole. "You never were a tadpole."[4]

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[4] Stevenson, Robert Louis, Fables, Coombe Springs Press. Sherborne, England: 1975. p.40.

Children enjoy conceptual play, and often are stimulated by humorous examples of intriguing ideas. We saw earlier how passages from **Through the Looking-Glass** and **Winnie the Pooh** could make use of humor to encourage philosophical inquiry.

In addition to indicating thought about a subject, children's jokes are often a kind of comic relief. Sometimes an original idea, although brilliant, may be so unusual that children will laugh at it simply as a release from the tension of being confronted with the unexpected.

Humor expresses the disparity between what is, and what is not but might be, and, in doing so, provokes insight into new possibilities. Teachers should be sensitive to the presence of thinking that humor may indicate, and provide activities that explore humorous situations, as well as activities that invite students to express their own ideas humorously.

The attitudes and dispositions described above are some of the noncognitive factors that stimulate and enhance higher level thinking in students. Naturally, classroom environment plays an important role in successful teaching for thinking. Here is an informal checklist of suggestions for creating an atmosphere conducive to critical and creative thinking.

1. Create a climate of mutual respect and appreciation among students in the classroom.
2. Support and reinforce unusual or innovative ideas.
3. Allow time for students to think about and develop creative ideas.
4. Allow time for students to be immersed in wonder.
5. Encourage and appreciate thoughtful humorous response from students, and seek humorous material to provoke class discussion.
6. Resist closure and criticism during divergent thinking activities.
7. Encourage the deferring of judgment while analyzing information.
8. Be aware that creative thinking can be expressed in many ways--through the arts, musically, through movement and dramatics, in verbal and written response, etc.
9. Value and explore insight gained through intuition.
10. Encourage students to doubt and question, and provide "dubious" materials to challenge students' critical thinking abilities.

11. Encourage students to be open-minded about the ideas and opinions of others.
12. Invite students to express their own points of view, and encourage them to seek the opinions of their classmates.
13. Invite students to share how they feel about situations, and act as a model by telling students how situations make you feel.
14. Encourage activities that involve risktaking, and respond warmly to students who brave ridicule while expressing an unusual idea.
15. Ask students to determine when they think a project or problem has been satisfactorily completed, and encourage self-reliance by allowing students to plan and evaluate a project from start to finish.
16. Encourage curiosity and inquiry.
17. Encourage experimentation by minimizing criticism when unexpected outcomes or results occur.
18. Let everyone get involved, and demonstrate the value of involvement by supporting students in designing and evaluating classroom materials and activities.
19. Invite students to reflect on their own goals, values, and needs, and ask them to think critically about how a proposed course of action will meet them.
20. Show students the value of exploring more than one possibility, and ask them to make a choice and explain why the choice was made.
21. Encourage students to seek feedback and criticism from their classmates.
22. Create experiences that allow students to confront and analyze their own expectations.
23. Do not be afraid of unanswered questions. Show students that there are times that you will be learning along with them.
24. Show that you value the process of thinking, as much as the right response.
25. Help students to recognize the difference between critical thinking and creative thinking.

SUGGESTIONS FOR PARENTS AND FRIENDS OF THE GIFTED

Critical and creative thinking is not confined to the classroom. Gifted children relish intellectual challenge and, with a bit of imagination, parents and friends of the gifted can find many opportunities to stimulate thinking. One way to encourage critical and creative thinking outside of school is to provide activities that develop children's self-reliance, and require them to draw upon their own resources to solve problems.

Naturally, the first example that comes to mind is household chores. Often, chores are carried out in a certain way simply as a matter of habit. Invite children to redesign a household duty to make it more efficient or agreeable. Use a creative problem-solving strategy. The household problem might be the way garbage is removed from the house and sanitarily stored so that neighborhood dogs do not rummage through it before trash day! Ask children to brainstorm several alternative solutions, develop criteria to evaluate them (e.g., solution will not anger dog owners), and have the children be responsible for implementing and monitoring the solution from start to finish. Other household problems to solve may include: how to keep your room clean, what to do with used newspapers, and how to avoid grumpiness in the morning.

We have seen that critical and creative thinking often involves the educator in the learning process. In an atmosphere of openness and curiosity, there is no need to be afraid to discuss difficult ethical and philosophical issues with children. The previous section on philosophy described several issues that were challenging and thought provoking for children and adults alike. Ethical problems occur often around the home, and sometimes they are resolved according to principles which seem ambiguous or illogical. Matthews, in **Dialogues with Children**, tells the story of a young boy who was asked to give up watching his favorite television show so that three visiting cousins could watch the show they preferred. Over dinner that evening, the child asked his mother, "Why is it better for three people to be selfish than one?" His mother did not have a ready answer, and later, when Matthew discussed the anecdote with a class of gifted students, an interesting discussion ensued (in the children's own language) comparing the concept of utilitarianism, the idea of the greatest good for the greatest number of people, to the Golden Rule, the maxim that you should do unto others what you would have them do unto you.

Television programs and advertising also are rich sources for critical and creative thinking. Children can fruitfully analyze the shows they watch, even if the shows themselves are superficial. Some questions about programs include: Why do the characters act the way they do? Are they convincing? What filming techniques (close-up shots, etc.) are used to provoke viewer's emotions? What is the sense of right and wrong being portrayed? If you were in a similar situation, how would you act? How might a certain program influence the way you feel about things? Almost all advertising uses some form of argumentation, either valid or invalid, to persuade consumers to buy a product. Happy, smiling children surround a woman using a particular brand of laundry detergent. What is the suggestion? Is it well-founded? A "leading report" favorably compares an advertiser's product with Brand X. What is "the leading authority?" Is it reliable? Are the quoted statistics sufficiently objective and comprehensive to warrant a conclusion? How might you find out?

Parents ask children if they have done their homework. If the answer is "yes," the parent often stops the questioning there. But, parents

also can ask children why they [children] think they are learning what they are learning. How does it relate to other school subjects? What kind of thinking does the homework involve? In what situations might the skills they are learning be useful?

In addition to analysis and evaluation, there are plenty of opportunities for creative thinking at home. Parents and/or friends can challenge children by asking the child(ren) to create a sculpture out of used egg cartons, to invent a new machine using a broken radio, or to find out on their own the answer to a problem or why/how something works. One parent tells the story of his gifted ten-year-old who yearned, like so many other children do, to dig a deep ditch to find out where it would lead. Finally, the parents agreed to let the child have a small section of the backyard, and the boy went to work. At the telling of the story, the ditch was several feet deep and the child was still digging from time to time. He had not reached the "bottom" yet, but several interesting discoveries had been made--about the local watertable, underground insect life, the consistency of soil, etc. The parents encouraged experimentation by asking their child to discuss and analyze his findings with the rest of the family.

Of course, not all parents will find this a practical or desirable activity. But initiative in learning is essential to the development of higher level thinking skills, and gifted children are usually bursting with ideas they would like to explore. Children should be encouraged to design experiments, create inventions, and solve and analyze problems around the home whenever possible or appropriate. Critical and creative thinking thrives in any warm and supportive environment that encourages curiosity, self-reliance, discussion, and follow through.

VII. CONCLUDING THOUGHTS

Writing this book has been a very special experience for me. I have become acquainted with several exciting programs for gifted and talented students throughout the state, and have had the chance to review and compare a wide variety of interesting materials and curriculum. More importantly, I have had the opportunity to speak with many talented and dedicated teachers, who have unreservedly given their time and expertise, despite the pressing demands of their overly busy schedules. My teaching, as well as my personal life, has been greatly enriched by these conversations.

The research has taught me a great deal, and I've been able to make some informal observations about the ingredients that contribute to the successful teaching of critical and creative thinking. The following section describes some of the qualities that effective programs and materials seem to have in common.

THINKING ABOUT THINKING

Because teaching critical and creative thinking stresses the process of learning, the subject being learned consists largely of an awareness of one's own mental activity. Students benefit from reflecting on the way they think about things, and discussions about thinking seem to give them an exciting sense of mastery over their own mental processes.

Much research is being done these days in the field of "thinking." There are studies on left brain/right brain approaches to learning, on "the untapped potential of the brain," on different modes of thinking and individual learning styles, etc. The final authority on which learning or thinking models are most effective can only be the individual thinker. In order to determine what kind of thinking is appropriate to various situations and problems, learners must be able to reflect on their own thinking processes. Classrooms in which students are taught to identify specific thinking skills, and encouraged to discuss how they think, what they wonder about, why they doubt, and when they use different thinking skills, seem to achieve a high and consistent level of critical and creative thinking.

Thinking about thinking imparts a valuing of the learning process, and encourages students to rely on their own resources to figure out how to gain new knowledge about a subject, and how to work through difficult problems by themselves.

TAKING RISKS AS A TEACHER

Teaching children to think for themselves involves risktaking for both teachers and students. Encouraging students to doubt and question

means that there will inevitably be unanswerable questions asked, and teachers may find themselves exploring territory that is as new to them as it is to their students. There is no need to be afraid of unanswered questions in the classroom, so long as students are provided with the time, means, and encouragement to look for their own answers.

Part of risktaking involves letting students feel that they're really on their own--that although their teacher may be a resource, he or she is not always willing or able to provide immediate answers to problems. The relationship between teacher and student is sometimes similar to that of a sports coach to her team. The coach knows how to play the game, and is expert at designing strategy and analyzing performance. But the team ultimately plays alone, and the coach is not the author of all the brilliant plays.

If a teacher feels that (s)he must always be the final authority in the classroom, students will never genuinely experience the challenge of relying on their own intellectual abilities. It was noted earlier that teachers and students can be partners in learning. Although it is true that the first prerequisite of teaching is to be familiar with the subject matter, it is important to remember that teaching for thinking stresses the learning process, and the subject with which the teacher should be familiar is thinking itself. Teachers who successfully develop critical and creative thinking in their students seem to be willing to reflect on their own thinking processes, take risks in their teaching styles, and reconsider the connection between being an educator, and being an authority.

EXTENDING CRITICAL AND CREATIVE THINKING BEYOND THE CLASSROOM FOR THE GIFTED

Critical and creative thinking applies to all subject areas, and is important to gifted and nongifted students alike. Because of its cross-curriculum relevance, many teachers find that critical and creative thinking skills are enhanced when practiced in several subject areas. Teachers of the gifted who stress critical and creative thinking may find it valuable to share their expertise with others in their system by helping teachers to design activities that develop thinking, conducting workshops in regular classrooms, or sharing activities of interests to the rest of the school population.

Critical and creative thinking, especially as it occurs in creative problem solving, draws on the diverse abilities of all students. Creative problem solving in the regular classroom challenges all students, while allowing gifted students to achieve the full measure of their potential.

Teachers of the gifted can enhance their curriculum, as well as diminish the feeling of "separateness" between gifted and regular

students, by inviting input from teachers about subjects in other classes that can be enriched by critical and creative thinking strategies.

A P P E N D I C E S

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for Teachers

APPENDIX A:

CRITICAL AND CREATIVE THINKING PROGRAM
University of Massachusetts, Boston

UMass/Boston's Critical and Creative Thinking Program is an interdisciplinary graduate program primarily involving philosophy, psychology, and education. It offers an M.A. degree, various nondegree possibilities, and is involved in the development of higher degree options. The program is designed to provide teachers, curriculum developers, and other interested persons both with an understanding of the processes of critical thinking and creativity and with ways of helping others develop these basic skills in a variety of formal and informal educational settings, especially including elementary, middle, and secondary schools. This aim is accomplished through the integration of several components:

- psychological studies of the scope, limits, and techniques of critical and creative thought, information processing, and conceptual learning in children and young adults;
- philosophical studies of the techniques of reasoning, argument, logical thinking, valuing, and judging; and
- educational techniques for stimulating creativity, critical thought, and their expression, in both children and adolescents.

The program's emphasis is on helping teachers restructure what they teach to infuse critical and creative thinking throughout the curriculum. Courses offered through this program are available at UMass/Boston's Harbor Campus, as well as at off-campus sites, including Cape Cod, the North Regional Educational Center, and various school systems.

The Critical and Creative Thinking Program is the only program of its kind in this country, and a valuable resource for Massachusetts educators.

For further information, contact:

Critical and Creative Thinking Program
University of Massachusetts at Boston
Harbor Campus
Boston, Massachusetts 02125-3393
(617) 929-7885

APPENDIX B:
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APPENDIX C: MASSACHUSETTS SCHOOL PROGRAMS AND TEACHERS CITED IN THIS PUBLICATION

ACTON: Grades 1-6 **Basic Challenge** Merriam Building, Room 5 Charter Road Acton, MA 01720	Caroline Tripp, Director (617) 263-0978 Mariann Eden, 6th grade teacher
FRAMINGHAM: Grades 1-5 **SAGE*** 454 Water Street Framingham, MA 01701	Diane Modest, Director (617) 875-4253
HANOVER: Grades 3-5 **SAGE* [Shared Approach to Gifted Education]** Center Elementary School 65 Silver Street Hanover, MA 02399	Connie O'Brien, Director (617) 826-2631
TRITON ACADEMIC REGIONAL: Grades 7-12 **Olympics of the Mind [OM]** Elm Street Byfield, MA 01922	John Lovering, 8th grade teacher (617) 462-8171
ORLEANS: Grades 4-8 **Future Problem Solving** 78 Eldredge Parkway, RR 2 Orleans, MA 02653	John Stewart, 8th grade teacher (617) 255-0380

* Framingham's SAGE and Hanover's SAGE are unrelated programs.

APPENDIX D: INSERVICE EDUCATION THROUGH THE COMMONWEALTH INSERVICE INSTITUTE

The Commonwealth Inservice Institute (CII) funds a variety of inservice training programs that are participant developed, voluntary in nature, and designed to meet local needs and to promote federal and state priorities.

CII is based on the principle that inservice education is radically different from other types of training. Unlike many graduate courses and workshops, CII responds to the specific needs of practitioners, giving them the opportunity to design and direct their own inservice training programs.

CII funds a wide range of programs, including those listed below that are designed to develop or improve instruction in critical and creative thinking. The Institute especially welcomes proposals that address the needs of economically disadvantaged and minority students. All elementary and secondary school personnel are eligible to apply for CII grants of up to $3,000 per year (see inside back cover for CII contact names).

CII/Critical & Creative Thinking Grants*
September 1984-June 1985

LEA: School(s)	Title	$ Amt.
BOSTON: • Thompson Middle	Applying Thinking Skills Across the Curriculum	$1,238
BROOKLINE: • school district	Future Problem-Solving Techniques	$2,135
BUCKLAND-COLRAIN-SHELBURNE: • school district	Logo for Teachers (staff learned how to implement a Logo curriculum that will enhance the development of children's thinking, problem-solving, and planning skills)	$1,150

* Funding source of all listed grants: State/Local Aid

LEA: School(s)	Title	$ Amt.
CENTRAL BERKSHIRE REGIONAL: • Craneville Elem. • Kittredge Elem. • Crane Community • Becket Consolidated	Interpretive Reading (helped teachers and specialists to develop students' higher order thinking skills while expanding, enriching, and improving their reading comprehension)	$1,344
FALL RIVER: • Doran Annex • Leontine Lincoln • F.M. Silvia • Westall	Development of Inquiry Strategies K-3	$ 785
GROTON-DUNSTABLE REGIONAL: • secondary school • Roche • Prescott • Swallow Union	Project Think	$2,369
HOPKINTON: • Elmwood • Center	Developing Thinking Skills	$1,387
LELAND HALL SCHOOL	Study Skills for Special Needs Students (included learning strategies for encouraging critical analysis)	$1,936
NATICK: • school district	Math Problem Solving: Improving the Skill (how to use math skills in every day problem-solving situations)	$1,580
NEWBURYPORT: • Brown • Belleville Elem. • Kelly Elem. • Newburyport High • Rupert Nock Middle	Developing Critical Thinking and Problem-Solving Skills	$2,176
NORWELL-DUXBURY-HANOVER-HULL-SCITUATE	Learning to Think Can Be Fun	$ 653
READING: • J.W. Killam Elem.	Children's Literature (includes the relationship between children's literature and higher level thinking skills)	$1,125

LEA: School(s)	Title	$ Amt.
SCITUATE: • Cushing Elem. • Hatherly Elem. • Wampatuck Elem.	Improving Critical Thinking Skills Using Microcomputers	$1,188
STONEHAM: • Central • Colonial Park • Robin Hood • South	Developing Critical Thinking Skills Through Literature and Reading	$1,472
WATERTOWN: • High School	Strategies in Problem Solving	$ 765
WAYLAND: • Junior High School	Thinking Skills: A Middle School Study Action Team	$1,750
WESTBOROUGH: • Junior High School • Senior High School	Methods to Improve the Quality of Student Thinking	$1,897
WESTFORD: • school district	Institute on Critical Thinking Skills for Teachers K-12	$2,[illegible]37
WESTWOOD: • Sheehan Elem. • Downey Elem. • Thurston J.H. • Westwood S.H.	Synectics Educational System's Creative Thinking Program	$1,550
	Total	$28,637

APPENDIX E: BIBLIOGRAPHY

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